VOL 62 NO.1 JANUARY/ FEBRUARY 1998

NZIC

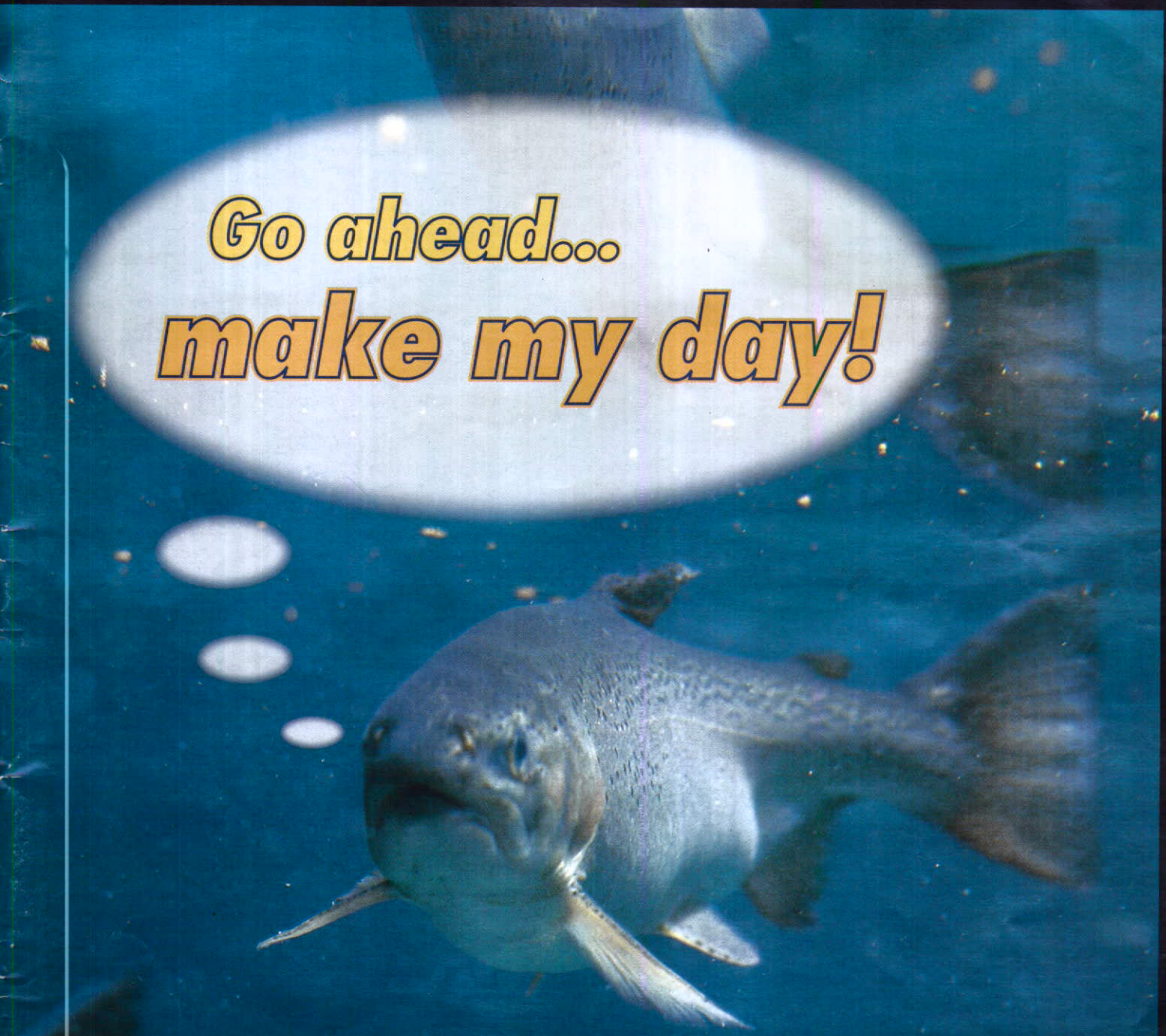
Chemistry

IN NEW ZEALAND

ISSN 0110-5566

SPOTLIGHT ON THE ENVIRONMENT, FOCUS ON GC AND GC-MS

Go ahead... make my day!



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UP FRONT ...

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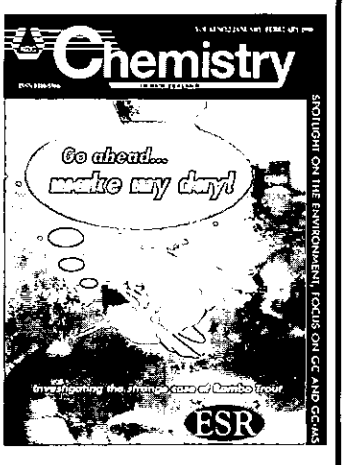

For further information see the cover story article on page 2

NZIC Chemistry IN NEW ZEALAND

Published on behalf of the New Zealand Institute of Chemistry in January, March, May, July, September and November each year.

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HPLC, IC, LC-MS

May 1998 - Forensics, Toxicology, and Clinical Chemistry
Centrifuges, Liquid Handling

Deadline for material:
5th of the month of publication

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COVER STORY

Go ahead ... make my day!

Investigating the strange case of Rambo Trout

HAH Pollution and New Zealand Sea Mammals

Although the stranding of whales and dolphins along the New Zealand coastline is a sad event, ESR's Land and Hazardous Substances Group is working to make the best of a bad deal.

The group recently presented data to the International Whaling Commission on the blubber concentrations of polychlorinated dibenzo-*p*-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs) and polychlorinated biphenyls (PCBs) in a range of whales and dolphins stranded in New Zealand. The study includes Hector's dolphins, dusky dolphins, southern right whale dolphins, blue whales, minke whales, and pygmy right whales.

This research makes a significant contribution to the limited amount of information available on the concentrations of halogenated aromatic hydrocarbons (HAHs) in cetaceans from the Southern Hemisphere.

ESR Environmental Toxicologist Paul Jones says the research reveals valuable information about the level of pollution in the marine environment. "Because whales and dolphins bioaccumulate high levels of HAHs, they act as 'indicators' of pollution," he says.

Accumulating HAHs internally also poses a risk to the mammals' health. In some Northern Hemisphere studies, reproductive problems have been noted in cetaceans (whales and dolphins) contaminated with a range of HAHs.

ESR's research focused on PCDD, PCDF, and PCB congeners in the blubber samples. Each congener has a Toxic Equivalency Factor (TEF), which measures the potency of individual HAH congeners compared to the most potent HAH congener, 2,3,7,8-TCDD. The concentration of each congener in an extract was multiplied by its TEF, and the sum of these values gave the total toxic equivalents (TEQs) concentration, or overall level of contamination, in the blubber extract of the marine mammal.

TEQs were lowest in the baleen whales (minke, blue, and pygmy right whales), higher in the open ocean toothed cetaceans (dusky dolphin, common dolphin, southern right whale dolphin, Cuvier's beaked whale) and highest in the Hector's dolphin, which feeds and lives inshore.

PCB congeners were detected in all the samples analysed. The lowest levels of PCBs (<50 ng/g wet weight) were found in open ocean baleen whales, with medium levels (100 to 500 ng/g wet weight) found in open ocean carnivores (beaked whales and open ocean dolphins) and the highest levels (750 to >1000 ng/g wet weight) in the Hector's dolphin.

PCDD and PCDF congeners were only commonly detected in the Hector's dolphin. In the baleen whale species and most other open ocean cetaceans, the levels of these congeners was below detection.

Relating the levels of PCB congeners in different species to their TEQs suggests that these groups are exposed to different PCB sources. The ratio of TEQ accumulated per mass of PCB is higher in the Hector's dolphin than in the open ocean species, suggesting that the Hector's dolphin is exposed to a more potent HAH source.

In all the mammals except the Hector's dolphin, PCDD and PCDF did not contribute significantly to the total TEQ. Previous research has also shown that PCBs account for most of the TEQ of Southern Hemisphere mammals. This may be because cetaceans can metabolise PCDD and PCDF congeners but is more probably because these HAHs have limited movement in the atmosphere.

PCB concentrations in the various species indicate that the accumulation of PCB relates to both feeding habits and proximity to the coast. For example, beaked whales in the study accumulated higher levels of PCBs than baleen whales. Both are open ocean species, but baleen whales feed lower in the food chain. Higher concentrations of PCBs in Hector's dolphins than in common dolphins suggest that inshore species are subjected to a higher exposure of PCBs.

The research concludes that PCBs are probably spread in the atmosphere. This conclusion is founded in the high proportion of lower chlorinated (more volatile) PCB congeners in open ocean marine mammals.

"PCBs were widely used in the past but are now essentially banned globally," says Paul Jones. "They were never produced in New Zealand, but they were imported for use here. The relatively large amounts of PCBs still present in the environment are the legacy of previous overuse and poor disposal methods."

From Sea Mammals to Freshwater Trout ...

Further inland, ESR's Environmental Organics group has been testing trout tissue for contamination from a pesticide dump at Flaxy Creek, near Te Anau.

ESR was called in after a Southland Fish and Game Council fishing survey found that 20 percent of the juvenile brown trout in the area looked mutated, with unusually large back muscles.

"This discovery caused a furore, as the dieldrin dump 1.5 kilometres downstream was thought to have caused the deformity." says Paul Jones, Environmental Toxicologist for ESR's Land and Hazardous Substances Programme Area.

However, ESR's analysis revealed only trace levels of dieldrin in the fish tissue. Consequently, the ESR report to the owners of the dump, Land Information New Zealand, concluded that this level of dieldrin could probably be described as normal for New Zealand freshwater fish. The occurrence of such contamination is the result of general environmental contamination with organochlorines (pesticides and polychlorinated biphenyls).

The report stated that the trout were unlikely to have been exposed to recent or ongoing amounts of chemicals from the dump site, because their tissue did not contain organochloride residues. Paul Jones says the fish may have been exposed at a younger age. Another cause could be a genetic mutation in one particular spawning, which coincidentally showed up near the dump. "A chemical cause to the enlarged muscles hasn't been ruled out, but with the limited information available, it's probably unwise to speculate further," he says.

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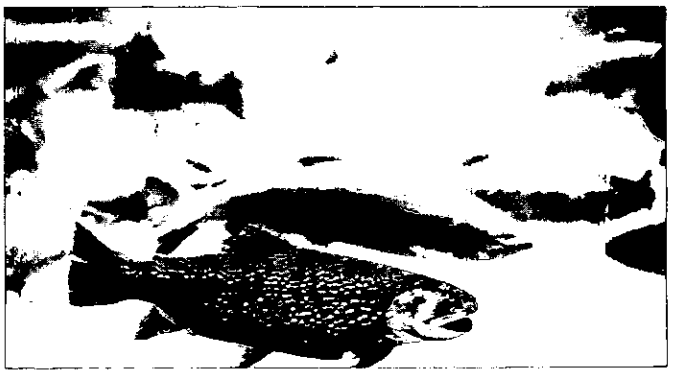


LOCAL NEWS

MORE TIME REQUIRED FOR GENETICS LAW

The implementation of the Hazardous Substances and New Organisms Act has been deferred to allow the Government more time to set up the new regime.

The provisions relating to genetically modified organisms are scheduled to come into effect in July 1998, while those relating to hazardous substances are aimed for October 1998. Originally both were to have come into force in April 1998.

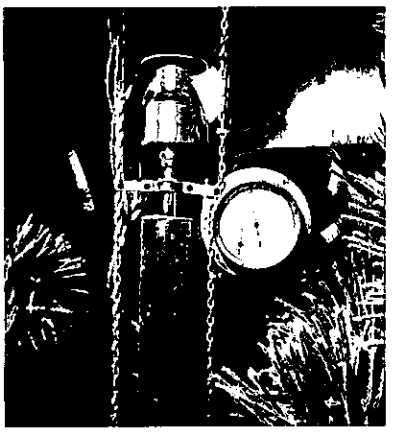
The Minister for the Environment, Simon Upton, said there was little to be gained by insisting on a tight timeframe when with more time "we can deliver a more stable and complete system that is workable."

SCIENCE HELPS FROZEN ASSETS TO SURVIVE

A new tool to help the forestry industry assess the costly risks associated with new planting is being researched.

A computer model will be able to predict how frost tolerant *Pinus radiata* seedlings will be at any time of year. Matching that information with climate details of a site will enable the forestry industry to take informed decisions about where and what to plant.

HortResearch scientist Dennis Greer has been working on how plants, which can withstand significant amounts of frost in winter, can die after just one early or late season attack.



He found that plants had both a day length and temperature requirement for frost hardiness development. Day shortening, rather than short days, was the key in early autumn while it was temperatures below 5 °C in winter that made pines harden to tolerate frost. Warm temperatures and day lengthening made them deharden in spring.

Since January 1997 he has been using the National Climate Laboratory to expose seedlings to different day but the same night temperatures. Seedlings in the controlled environment rooms at 25/1 °C (day/night) over 84 days did not harden and would only tolerate about -5 °C. At 20/1 °C they hardened down to -10 °C. Seedlings at 15/1 °C went to -13 °C and those at 10/1 °C were able to tolerate -14.5 °C.

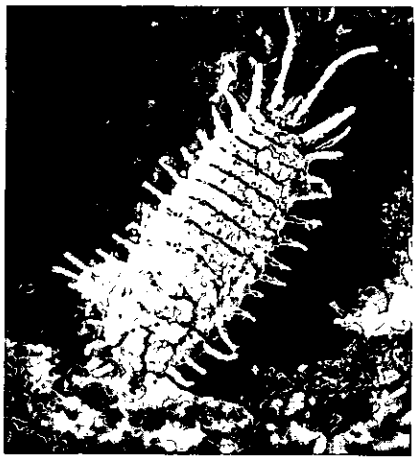
Another question was whether the amounts of carbohydrate in plants in winter affected their frost tolerance. The trees should accumulate different amounts through the balance between photosynthesis and respiration. Until results are analysed, however, the jury is still out.

"Now we want to know about genetic variation in physiological terms. Do plants have a steeper or flatter hardening response to temperature through genetic predisposition?"

Source: HortResearch Seasons, Number 21.

DNA TEST BREAKTHROUGH FOR EXPORTS

New DNA tests for mealy bug identification are estimated to have saved the New Zealand apple industry at least $1 million in the first season of use.



Each year samples from about four million apples are inspected by the United States Department of Agriculture for the one species of mealy bug out of four that is considered to be a quarantine pest.

Until recently if a single mealy bug was found, an entire consignment - as many as 50,000 cartons of apples - would have to be held in cool storage for up to 60 days until tests could be carried out to identify the species. Mealy bugs found on pip fruit are usually at a juvenile stage and conventional techniques could not accurately identify them until they reached adulthood.

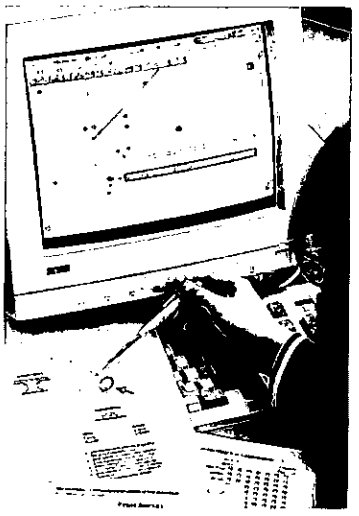
HortResearch's Gene Transfer and Expression Group has developed DNA probes which give results within 48 hours. Probes to identify two species of mealy bug were ready in time for the 1996 apple export season with tests for the remaining two species completed by the middle of 1996. The test has also been fine-tuned to distinguish even the smallest mealy bug, a fraction of the size of a pin head. Eggs and adult males which could not be identified by conventional methods, no longer pose a problem. The development is a world first as DNA technology has not been used before to identify insects on export consignments.

As supervisor of the work, scientist Lesley Beuning has since accepted a HortResearch Chairperson's Award for Outstanding Achievement on behalf of the Mealy Bug Identification Team for their contribution to export growth through excellence in science. The research, carried out in conjunction with the New Zealand Apple and Pear Marketing Board, took two years to complete.

Source: HortResearch Seasons, Number 22.

BIOTECH 'BETTER THAN CHEMICALS'

The average Kiwi is happy with the idea of genetically modified fruit if it means bigger, tastier food with less chemical residue, according to a survey by HortResearch's Food Science Group.



A postal study was carried out to measure New Zealanders' perceptions of the relative risks and benefits of a variety of fruit production methods - "genetic engineering", use of chemical fertilisers, chemical pesticides, organic farming, and irradiation.

The 511 respondents ranged in age from 15 to 60 years and came from both rural and city backgrounds. Scientist Nicola Harman found there was much consistency in their attitudes, despite wide variations in age, locality, socio-economic status, and ethnicity.

"The benefits of genetic engineering in fruit production were perceived to outweigh the risks to consumers and the environment. However, the use of pesticides and irradiation in fruit production were considered to be unacceptably risky techniques with few benefits."

Organic farming was perceived to have the highest benefits and lowest risks, and so, was the most acceptable of the techniques tested. Although the majority (75-90%) of respondents had heard of "genetic engineering", less than half had heard of the term "transgenic". When asked if they would eat an apple that had been "genetically engineered", about two-thirds stated that they would if it had increased size (62%), improved flavour (67%) or reduced chemical residues (66%).

Only a minority of respondents predicted that they would knowingly eat an apple which had been sprayed with pesticides to reduce pest damage (33%) or irradiated to reduce the need for chemical pesticides (31%).

This research is continuing with the 1997 Eurobarometer Survey of Public Perceptions of Biotechnology being conducted by HortResearch, Crop and Food Research and supported by MoRST and MAF.

Source: HortResearch Seasons, Number 22.

WORLDWIDE BLUE WATER CORROSION PROBLEM CLOSE TO SOLUTION

Having a flush of blue water in your toilet bowl may not be a problem, but it is not so welcome when you turn on the tap for a drink. Yet the problem is found in pockets of populated areas throughout the world. New Zealand researchers may provide the answer, however.

The blue water phenomenon occurs in copper pipe systems where copper ions build up in water which is stagnant through infrequent tap use. The resulting cloudy blue water is not just aesthetically unpleasing. High levels of copper in water are a health problem. The United States standard for copper in drinking water is 1.3 parts per million. Blue water usually has 10 parts per million or more.

Industrial Research corrosion scientists are working with microbiologists from the Crop and Food Research Institute on a project to help solve the problem. The joint project is partially funded by the International Copper Association and has run for four years.

In New Zealand, Auckland suffers the most, followed by Dunedin and Christchurch. Auckland's warmer climate is one possible reason why it tops the list, Industrial Research scientist Barbara Webster says.

Research has found a direct link between corrosion and bacterial activity within biofilms (slime-like growths) growing on the surface of the pipes. Researchers are now looking at remedies. Treatment requires removing the biofilm, which requires raising the acidity and breaks down the protective oxide film on the surface of the pipes. Heat treatment has proved effective in killing bacteria on pipes in the laboratory. It is also being trialed at a Auckland house with pipes being exposed to 75 °C water for at least 10 minutes. This is followed with a flush of cold city supply water for 30 minutes. Then, for up to two weeks, the pipe system will be flushed daily for two minutes with cold city supply water containing chlorine.

A thick layer of corrosion product covered around ten percent of the sample pipe surface.

Barbara Webster says maintaining the chlorine level is crucial to preventing the re-establishment of the corrosive biofilm. "There has to be a very controlled period where we allow the oxide film to establish, then maintain the residual chlorine. Often achieving this doesn't require a great deal of change in the system."

Chlorine levels tend to be low at the end of domestic supply lines, or where carbon filters are used incorrectly, and where water is stagnant for long periods, such as at large sites where taps at the ends of long pipes are not used often.

Links between blue water and pitting in copper hot water cylinders will be examined in the future.

Source: Industrial Research Limited, Innovate, Issue 26.

PUTTING A FACE ON PASTORAL GREENHOUSE GASES

Innovative research in the Manawatu is studying the effect of increasing atmospheric carbon dioxide levels on pasture growth. The work is part of an intensive international scientific effort to understand how higher carbon dioxide levels in the atmosphere will influence agricultural and natural ecosystems, and how ecosystem responses will feedback on greenhouse gas levels in the atmosphere.

Depending on the reduction in gas emissions that can be agreed upon by governments, the Intergovernmental Panel on Climate Change predicts that carbon dioxide levels in the atmosphere will increase by 35-170% during the next century.

Irrespective of the effect this increase might have on the climate, experiments in controlled environments have shown that an increase in carbon dioxide can alter forage supply, say AgResearch scientists Paul Newton and Harry Clark.

"The task now is to determine whether the changes in yield, seasonal distribution of yield, botanical composition, herbage quality, and nutrient cycling that we have measured in controlled environments also occur in the field under grazing. We also need to have a better appreciation of the contribution pasture makes to greenhouse gas levels and how this may change as carbon dioxide concentration in the atmosphere increases. This is important because of the possible effects carbon dioxide, nitrous oxide, and methane have on our climate."

To gain an understanding of these changes, AgResearch has established a field laboratory to enrich pasture with carbon dioxide. Also collaborating in the venture are Plantplan, a Palmerston North company specialising in environmental control systems, Landcare Research, and BOC Gases.

The laboratory, set up at AgResearch's Flock House, near Bulls, uses a technology called Free Air Carbon Dioxide Enrichment (FACE) to deliver a controlled amount of carbon dioxide to pasture. "FACE was developed in the United States, but we have redesigned it and built it here to reduce costs," the scientists say. "The Flock House experiment is the only FACE in the southern hemisphere and is the only experiment in the world to include animals grazing *in situ*."

The FACE system allows scientists to measure responses of plant communities to high carbon dioxide levels with minimal disturbance to the biological system. "It is more realistic than using greenhouses or small chambers which change other characteristics of the environment such as temperature. FACE also allows us to enrich areas of sufficient size so that grazing animals can be included."

The AgResearch FACE comprises of a 30 cm pipe buried in the ground, with 24 vertical pipes forming a circle 12 m in diameter. Carbon dioxide diluted in air is released from the vertical pipes on the upwind side of the circle and blown across it. "An environmental control system decides how much gas should be released from which pipes by testing the carbon dioxide concentration at the centre of the ring and also the windspeed and wind direction. Our FACE has three rings enriching with carbon dioxide and three control, or non-enriched rings."

The New Zealand facility is one of an international network of trials, and FACE experiments are now, or soon will be operating for crops such as cotton, wheat, potatoes and rice, forest ecosystems including evergreen and deciduous forest, as well as grasslands."

KNOWLEDGE BASE REPORTS

The considered opinions of 143 of New Zealand's leading scientists have been published by MoRST in the Knowledge Base reports. The contributors, and over 600 of their colleagues who reviewed their work, sought to answer questions in their area of expertise, such as: How did we get to where we are today? Where are we strong and where are we weak? What opportunities exist for the future? Who and what is involved in generating this knowledge, and are the current human resources and infrastructure adequate?

This wealth of information will be used by MoRST in various ways. The reports are part of a wider information base for the Foresight Project. Initially, the reports will help those involved in developing sector strategies understand the present state of science knowledge in New Zealand. Also, the opportunities that have been identified will be a useful input into the Foresight Project. As clearer pictures emerge of where New Zealand science needs to be, the reports will help describe where we must move from. In this way the knowledge base will feed into setting priorities for public investment in science and technology in a way that will help us make conscious decisions on where to reposition our research skill base.

The reports will also form the basis of a new science and technology indicator of knowledge flows and links, measuring the extent of overlap between the fields of research identified in the knowledge base and the private sector's own research. Finally, MoRST plans to address the major issues highlighted in the reports, deciding appropriate actions in response to them.

There are twelve reports. The first is an overview and the remaining eleven cover the separate discipline areas of mathematical, physical, chemical, earth, applied, engineering, biological, agricultural, medical and health, and social sciences, and information, computer and communication technology. The reports are available in hard copy from MoRST and will be available at http://www.morst.govt.nz. They will be linked to an extensive database currently being developed as part of the Foresight Project.

THE FORESIGHT PROJECT - UPDATE

The Foresight Project, to develop science and technology priorities for our future as a knowledge society, is now well underway. A lot has happened in this project over the last few months.

Communication Initiatives

The *Vision* newsletter has been established with issue one published in October 1997. This publication will inform stakeholders of progress as the Foresight Project develops over the next two years. The first issue outlines the Foresight Project and where it will go over the next two years.

Also recently established is the Foresight website. The site is part of MoRST's website and can be accessed via http://www.morst.govt.nz/foresight. The overall aim of the site is to provide a window into the Foresight Project, informing and enabling stakeholders to participate interactively as the project progresses. As the project evolves so will the material on the site. The site provides a wide variety of material, some of which is outlined below: a description and outline of the Foresight Project; a set of information folders - these include a range of material relevant to the Foresight Project, such as the results of a series of interviews that were conducted with key thinkers from around New Zealand; and a series of virtual discussion forums.

Insights of New Zealanders

The first series of interviews with some of New Zealand's key thinkers have been completed. The interviewees were challenged to think strategically about New Zealand's future, as well as the future of their respective sectors. Over 100 individuals were interviewed, including chief executives from a wide variety of business sectors, a number of university vice chancellors, chief executives and chairpeople from New Zealand's Crown Research Institutes, community leaders, opinion leaders, politicians, and a number of leading journalists.

Nine foresight drivers were identified: the knowledge revolution, globalisation of commerce, science and technology, governance, education, the environment, changing needs/preferences of consumers, industry convergence, and New Zealand's social structure, cohesion and values. A more detailed outline of these drivers is available via the Foresight website.

The Foresight Workshop

A two-day Foresight workshop was held on 5 and 6 December 1997. The workshop engaged key stakeholders from New Zealand's economic, social, and environmental sectors. The workshop resulted in the development of a shared set of scenarios for the future of New Zealand. These scenarios will now be used to stimulate the development of sector foresight strategies over the coming months.

Beehive Launch

New Zealand's Prime Minister, the Honourable Jenny Shipley, officially launched the Foresight Project on the 11 December 1997 at the Beehive. The launch was attended by key stakeholders in the Foresight Project including workshop participants, parliamentarians, and individuals from New Zealand's economic, social, and environmental sectors.

Next Steps

Early in 1998 the Foresight Project will move into its second phase. The objective of this phase is to develop a widely shared and compelling understanding of what is important for various sectors of our society and economy.

A key element of this phase is the development of stakeholder strategies. These will be facilitated and coordinated by MoRST. As part of these stakeholder strategies, sector groups in society and the economy will be encouraged to develop their own foresight, to define challenges and opportunities, and so to develop their science and technology priorities and strategies.

For a more detailed update on progress please visit the Foresight website. The next issue of *Vision* will be published early in 1998, this will outline in more detail the next steps in the Foresight process.

THE ASSOCIATION OF CROWN RESEARCH INSTITUTES PROMOTES PUBLIC GOOD SCIENCE AND TECHNOLOGY

The Association of Crown Research Institutes (ACRI) has released a spirited report, Shaping New Zealand's Future

Through Science and Technology, to promote outcomes and benefits of public investment in science and technology.

ACRI's Chairman, Paul Hargreaves, said that science reforms over the past five years had worked, that CRIs had paid their way and had not needed extra cash from the Government, and that CRIs had delivered significant benefits to New Zealand.

The report focuses on the contribution science and technology is making to New Zealand's future.

"The Public Good Science Fund (PGSF) is the primary vehicle chosen by the Government for investment in the research, science and technology which is leading New Zealand into the 21st century. The PGSF essentially underpins the operations of the Crown Research Institutes."

The report says further increases in funding for public good science and technology would enable:

- New Zealand commerce to maintain a competitive edge in global markets relating to the forestry, agriculture, horticultural, fishing, food, energy/geothermal consulting, electronics manufacturing and processing industries,

- local authorities throughout the country to maintain the quality of environmental and conservation standards demanded by New Zealanders,

- New Zealand to obtain adequate oceanographic and marine knowledge to explore and secure the most economically advantageous arrangements for its offshore exclusive economic zone. Included in this are the extended claims New Zealand will make to its seabed resources in Law of the Sea negotiations,

- New Zealand to capitalise on the position its research has achieved to date in placing the country among prominent global leaders in the fields of atmospheric, oceanographic, geothermal, geological (earthquake), agricultural, horticultural, forestry, marine research and electronics manufacturing and processing industries, and

- New Zealand to defend and prosecute its interests in global trade forums as technical and regulatory product specification barriers replace tariffs and quotas as the battle ground for product access to world markets under APEC and WTO future trade rules.

MoRST Chief Executive, Dr James Buwalda, said that public good science and technology are an integral part of a vibrant innovative society. "Public good science and technology underpins our development as a knowledge society, and our future success in a global economy. This will be an economy driven by fundamental technological change and a new ethos of openness. If New Zealand fails to join this trend, in particular its pursuit of technological progress, we will as a nation be left behind and unable to realise our aspirations for improved quality of life."

HEALTH RESEARCH ARRANGEMENTS

Dr Kathy Garden, Chief Policy Adviser, and Dr Bruce Scoggins, Director of the Health Research Council, have been travelling around the country outlining new arrangements for health research to audiences of health research providers.

Twenty-six million dollars has been transferred from Vote Health to Vote Research, Science and Technology and continues to be administered by the Health Research Council.

Dr Garden and Dr Scoggins explained how health research arrangements would be progressively aligned with arrangements for other areas of public good science and technology. This will involve:

- moves to fund all the costs of health research rather than only the direct costs as happens currently. Tertiary education institutions with a stake in health research have agreed informally to collectively contribute $9 million (GST exclusive) so that health research can begin to be fully funded. The principles and safeguards around this proposal are currently being worked through. The Government has also recognised that additional funding will be necessary to achieve full cost funding over the next three to four years,

- a new statement of priorities for health research will be developed through the Foresight Project and applicable from 2000/01. Until then existing policy guidelines to the Health Research Council will continue to guide priorities,

- a move away from a large number of small health research projects to portfolio purchasing with an emphasis still on maintaining the diversity of health research, and

- a review of work-force issues by June 1998 to determine whether the Health Research Council career development schemes for health research continue in their current form.

Questioning has been brisk and Dr Garden commented that she has come away with some good insights into the issues for the sector and the ways science and health could learn from each other.

RABBIT CALICIVIRUS DISEASE UPDATE

The presence of rabbit calicivirus disease (RCD) in New Zealand was confirmed in late August 1997. Since that time the Ministry has been actively involved in advising Government of the probable effects of the virus on rabbits and also in promoting research to answer the many questions about the behaviour of the virus in New Zealand conditions.

Immediately after the disease was identified near Cromwell the Ministry worked with MAF to ensure that scientists from Landcare Research were in the field monitoring the first stages of the establishment of the virus and its impacts on rabbits. This initial work has shown that the virus is spreading from rabbit to rabbit, but that the impacts are patchy, with very high kills in some areas and much lesser ones in others. The reasons for this are not yet clear.

The Ministry has also coordinated the funding for a tender for research into the mechanisms of spread and impacts of the virus. Funding from the Foundation for Research, Science and Technology and from MAF has been combined to fund research to follow on from the current Landcare Research study through

until July 1998 when new Public Good Science Fund research projects begin. A successful meeting was organised at Lincoln on the 10 November 1997, to bring potential research providers together with end users such as the farming community, regional councils, and the Department of Conservation. Tenders closed on the 21 November 1997 and successful applicants were informed in mid-December 1997.

NEW ZEALAND ELECTED TO THE BUREAU OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE

New Zealand has for the first time secured a position on the bureau, (the governing body) of the Intergovernmental Panel on Climate Change (IPCC), the key international body assessing the science of climate change.

Dr Martin Manning, from the National Institute of Water and Atmospheric Research (NIWA) was elected at the recent 13th Plenary of the IPCC held in the Maldives. The IPCC, which is sponsored by the World Meteorological Organisation and the United Nations Environment Programme, is the key body providing scientific advice on climate change issues to the Framework Convention on Climate Change (FCCC). It has been responsible for providing comprehensive scientific reports on climate change, the last being in 1995 entitled the Second Assessment Report. The IPCC is now planning to produce its next report to be finalised in the year 2000/1.

Dr Manning is project director and senior scientist with NIWA. He was elected as Vice-Chair of Working Group Two of the IPCC and is one of only 30 members elected from countries throughout the world. Working Group Two will consider the vulnerability and impacts of climate change.

Dr Manning is responsible for a wide range of climate research programmes. He has previously been associated with IPCC activities, as an expert reviewer and as a New Zealand delegate to meetings and workshops.

Dr Gerald Rys, Principal Adviser at the Ministry, says that it is important that Southern Hemisphere countries are represented on the IPCC Bureau, as the science issues in the Southern Hemisphere are different in nature from those of Northern Hemisphere countries, which are largely dominated by industrial economies.

THE FUTURE DIRECTORS AWARD TAKING SCIENCE AND TECHNOLOGY LEADERSHIP INTO NEW ZEALAND'S BOARDROOMS

Congratulations to the following winners of the Future Directors Award. This award aims to increase the number of key decision-makers with science and technology backgrounds in New Zealand business.

Dr Richard Gordon, a senior manager at Landcare Research; Mr Laurence Eyres, Group Operations and Technical Manager at Bluebird Foods Limited; Mr Norman Moritz, Operations Executive at Tip Top Ice Cream Company Limited; Ms Sally Davenport, Director of Master of Management Studies at Victoria University; Mr Kieran Devine, General Manager (Genération), ECNZ Limited; and Mr Bob Mills, Department of Technology, University of Waikato.

The award assists scientists, technologists, and engineers to develop expertise in areas that will enhance their prospects of directorship appointment. The six winners have attended or will be attending the Institute of Directors' Company Directors Course, which covers the duties, responsibilities, and personal liabilities, which arise from the diverse day-to-day activities of a public company. By sponsoring these places, the Government aims to increase the pool of science and technology decision-makers available to serve on company Boards of Directors. Through the activities of the awardees the Government hopes to promote a business culture that values the role of science and technology in business success.

As New Zealand moves away from a reliance on primary commodities towards more value-added, service orientated activities, its future success will be increasingly determined by its ability to recognise and make use of science and technology. New Zealand will need to have decision-makers in enterprise and industry who believe that science and technology is a major component of innovation and is important to their overall competitiveness. Statistics indicate that New Zealand companies continue to bias directorship appointments towards people with financial and legal backgrounds.

The Future Directors Award helps individuals, who already have a strong appreciation of how science and technology contributes to business strategy, break the 'glass ceiling' for science and technology educated people in business.

The objective of the Awards is consistent with the Government's recently established Technology New Zealand scheme that aims to unlock business growth potential.

SCIENCE AND TECHNOLOGY TEACHERS FELLOWSHIPS AWARDED

Sixteen teachers, ten from secondary schools and six from primary schools, have obtained prestigious New Zealand Science and Technology Teacher Fellowships for 1998.

The Fellowships, administered by the Royal Society of New Zealand for the Government, are awarded to science, technology, and mathematics teachers enabling them to spend up to one year in industry or research organisations to strengthen the science and technology curriculum.

The aim of the fellowships is to:

- enable teachers to further understand the role of science and technology in New Zealand's economy and society,
- provide teachers with new experiences and understanding outside the classroom that enables them to become more effective teachers, and
- promote a culture that values science and technology in education, enterprise, and in the wider community.

The teachers awarded scholarships are: Andrew Stafford (Manurewa High School), Angela Christie (Rangikura School, Porirua), Bu Windsor (Mount Cook School), Christine Gold (St Hilda's Collegiate School, Dunedin), Craig McGregor (Wharenui School, Christchurch), Heather Bell (Hastings Intermediate School), Mary Logie (Auckland Girls' Grammar), Melissa Bell (Macandrew Intermediate School, Dunedin), Michael Thornton (Timaru Girls High School), Monika Fry

(Kowhai Intermediate School, Auckland), Patricia Shanks (Glenfield College, Auckland), Ross Petersen (Aorere College, Auckland), Stephanie Paris (Lincoln High School), Terence Bunn (Taipa Area School, Kaitaia), Vicki Squibbs (Diocesan School for Girls, Auckland), Warwick Sandler (Michael Park School, Auckland).

The teachers attended a one-day seminar at the Royal Society of New Zealand headquarters in Wellington on 27 November 1997, where the Minister of Research, Science and Technology, the Honourable Maurice Williamson, congratulated the teachers on obtaining a fellowship and spoke about the value of the scheme in forging strong links between schools and the science and technology community in New Zealand.

"Science and technology are as much a part of New Zealand as the All Blacks, it's just unfortunate that public attention is not equally focused," the Minister said.

"The Fellowship Programme is well suited to enhance positive attitudes to science and technology in schools and in the wider community. The Science and Technology Teacher Fellowship Programme will only work when teachers like those of you gathered here today, reach out beyond your classroom to your professional and general communities to share the excitement of science and technology," the Minister said.

THE AGRICULTURAL AND MARKETING RESEARCH AND DEVELOPMENT TRUST POST-DOCTORAL FELLOWSHIPS

The Agricultural and Marketing Research and Development Trust (AGMARDT) was set up by the Crown in 1987 to promote and encourage in New Zealand's interest, the agricultural, pastoral, horticultural, and forestry industries. The Trust provides some funding assistance for the training of individuals towards appropriate advanced expertise in these industries.

AGMARDT has announced that commencing in 1998 it is establishing a Post-Doctoral Fellowship Programme. Up to three fellowships will be granted each year to provide two years' full-time research experience for scientists who have recently completed their PhDs and who propose to continue research careers in areas covered by the objectives of the Trust.

Fellows will be able to conduct their research at either New Zealand or overseas host organisations. However, the fellow is required to remain in, or return to, New Zealand on completion of the fellowship and be involved in the chosen field of research.

Eligible host organisations include research associations, Crown Research Institutes (or government research organisations in other countries), universities, polytechnics, business enterprises, and private sector laboratories. The host organisation must be able to support the fellow's project and provide all resources and equipment required to undertake the research.

The fellowship will be made by way of an AGMARDT contract between the fellow, the host organisation and AGMARDT. For research at a New Zealand host organisation, the funding will provide an average stipend of $44,444 ($50,000 including GST) and up to $20,000 (GST inclusive) as a contribution towards direct costs where appropriate i.e. a maximum value of $70,000 (including GST). In regard to research at an overseas organisation, the stipend and overall value of the fellowship will be determined by AGMARDT to reflect the costs of working in the particular country. Fellowships tenable in overseas countries will meet the fellow's travel expenses to and from the country.

It is envisaged that applicants will have completed all requirements for award of the PhD or equivalent within the two-year period immediately prior to the closing date for applications, being 6 April 1998.

For further information and application forms please apply to the Secretary Manager, AGMARDT
P O Box 399, Shortland Street, Auckland
Phone: (09) 3733370, Fax: (09) 3733488

COMPREHENSIVE NEW ZEALAND CHROMATOGRAPHY MARKET SURVEY RESULTS RELEASED

Ancat Holdings Limited have recently completed a comprehensive New Zealand market survey of all facets of the chromatography business including HPLC and IC instrumentation, columns, solvents and accessories, and GC/GC-MS instrumentation, columns, supplies and accessories. The results are available on a commercial basis for all parts of the survey. Contact: Robert Lyon, Ancat Holdings Limited, Phone: +64-9-5353475, Fax: +64-9-5353476, Email: ancat@ihug.co.nz for pricing or more details on the information available.

PESTICIDES SEMINAR

2nd February 1998

Medtec Products and Hewlett Packard are proud to present a full day seminar covering a wide range of topics that will be of interest to anyone involved in the analysis of pesticides. Topics covered include:

- Pesticides - Classification and Regulations.
- State-of-the-Art Instrumentation for Pesticide Analysis.
- The Importance of Sample Preparation in Pesticides Analysis.
- Future Trends and Concerns in Pesticide Analysis.

The seminar will be presented by Dr Pat J Sandra, Professor in Separation Sciences at the Department of Organic Chemistry, University of Gent, Belgium.

Professor Sandra received his MS Degree in Chemistry in 1969 and his PhD in Sciences in 1975 from the University of Gent, Belgium. Since then, he has been on the Faculty of Science at the same University where he is currently Professor in Separation Sciences at the Department of Organic Chemistry. In 1985 he founded the Research Institute for Chromatography in Kortrijk, Belgium, a centre for research and education in chromatography, mass spectrometry, and capillary electrophoresis. He is also currently Professor of Environmental Analysis at the Eindhoven University of Technology, The Netherlands. Professor Sandra is a frequent traveller presenting lectures throughout the world and appreciated for his high standard of teaching.

Contact: Peter Hermans, Medtec Products Limited
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Issues on Heavy Metals in Tannery and Timber Treatment Effluents

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1 Introduction

Heavy metals reach terrestrial and aquatic ecosystems through the disposal of various industrial effluents, application of phosphate fertilisers and municipal sewage sludges, and emission from power generation plants and smelters. Heavy metals include non-ferrous metals and metalloids with an atomic density greater than 6 gcm^{-3}, and are grouped into essential and non-essential toxic elements. Both the groups are toxic to animals and human beings at high concentrations (Alloway, 1995). Soils are polluted with a wide range of heavy metals, such as copper (Cu), chromium (Cr), lead (Pb), cadmium (Cd), zinc (Zn), arsenic (As), and mercury (Hg). Nriagu (1994) states that "we may be experiencing a silent epidemic of environmental metal poisoning from the ever increasing amounts of metals and metal containing materials".

In many countries, the tanning and timber treatment industries contribute a major source of effluents containing heavy metals. For example, in New Zealand, approximately 6400 and 1600 tonnes of tannery and timber treatment effluents, respectively are generated annually which contribute approximately 10% of the total hazardous waste (Jonathan *et. al.*, 1989). These effluents are enriched with toxic heavy metals, such as Cu, Cr, and As. Hexavalent Cr and As present in timber treatment effluents are considered carcinogenic.

In this paper the processes involved in the tannery and timber treatments and the techniques used to remove the heavy metals from these effluents and to remediate the soils contaminated with these heavy metals will be discussed.

2 Chromium Tanning Process

There are different types of tanning processes, namely chrome tanning, vegetable tanning, aluminium tanning, and zirconium tanning. Chrome tanning is used most commonly to treat all types of hides and skins. Although chrome tanning was discovered in 1858 by Knapp, the first commercial production of chrome leather is attributed to Augustus Schultz of New York in 1884.

In the chrome tanning process, the hide is brought to an acid condition at a pH of about 2. The chemical reaction involved in the chrome tanning process is the formation of a stable compound between the hide protein and Cr (III) ions. The hide protein contains free carboxyl groups and other reactive sites which form co-ordinate complexes with trivalent Cr. The affinity of the hide for Cr greatly increases in the pH range of 3-4. Chromium sulfate is commonly used for chrome tanning. Since the solution is strongly acidic the Cr salts can penetrate the hide without excessive surface fixation. After a period of time, when the Cr has penetrated the hide sufficiently, the pH is raised to promote the reaction of the Cr with the hide. Masking agents, such as sodium formate are used to decrease the sensitivity of the tannage to pH variation. The formate ion in the solution forms a basic chromium formate complex with the displacement of some of the sulfate from the Cr complex. The reaction is very strong and the resulting leather is resistant to decay, heat and mechanical damage. The tanning is done in a salt solution, such as sodium chloride to prevent osmotic swelling of the untanned hide. In chrome tanning, the quantity of Cr needed for complete tanning is about 2% of the weight of the hide.

The effluent generated after chrome tanning contains pollutants, such as Cr, organic dyestuffs, high biological and chemical oxygen demand, suspended matter, sodium and chloride. Chromium present in the tannery effluent is of major environmental concern (Plate 1). Hence treatment of these effluents is essential before they are discharged into the environment. From an environmental stand point, apart from Cr, sodium chloride and sodium sulfide may also cause concern depending upon the ultimate method of disposal of the effluent.

Plate 1. *Discharge of untreated tannery effluent with high Cr (III) concentration (3200 mg/L).*

3 CCA Timber Treatment Process

In New Zealand, approximately 1.4 million m^3 of timber is preservative treated annually. A number of timber treatment techniques are currently available in New Zealand that include, Copper-Chromium-Arsenic (CCA), boron, and light organic solvent. CCA and light organic solvent treatments utilise pressure to impregnate the preservative chemicals, whereas boron treatment involves surface application and the diffusion of boron based insecticides. Pentachlorophenol (PCP) had been widely used in the New Zealand timber industry in the past as an anti-fungal agent. Its use ceased in New Zealand from 1988 as workers health concerns became known to the industry. Soils contaminated by PCP and dioxins were of major concern at timber treatment sites.

Currently, CCA is the most commonly used timber treatment chemical. Copper acts as a fungicide, Cr as a fixative and As as an insecticide. Chromium helps to hold the other components tightly to the wood to prevent leaching, while As also guards

against attack by termites and copper-resistant fungi. CCA treatment of timber involves the impregnation under pressure of a 1-4% CCA solution. Working solutions of CCA preparations commonly consist of high concentrations of copper sulphate, sodium dichromate and arsenic acid, all of which are potentially highly toxic.

The Bethell (Full cell) vacuum pressure process is the most commonly used timber treatment process. In operation, the treatment chamber is filled with timber stacked on steel trolleys. It is sealed and a vacuum is applied to remove air from the timber, then the tank is flooded and pressurised with CCA preservative solution. The pressure is applied and the solution is pumped into the timber until total saturation is achieved. After the release of the pressure the treatment solution is returned to the working tank and a vacuum is applied to the cylinder for a short period to reduce dripping. After treatment the timber must be stored in a paved area for at least 24 hours. This paved area should be sloped to drain into a cylinder sump so that all the surplus CCA solution is retained. The most significant source of soil contamination occurs because of waste disposal practices and drips, leaks and spills of stock and working solutions (Plate 2). Rain falling onto the freshly treated timber is also responsible for CCA contamination of ground areas.

Plate 2. *CCA drips from freshly treated timber in a timber treatment plant.*

4 Contamination Due to Tannery and Timber Treatment Sites in New Zealand

In New Zealand, some tanneries discharge effluents with a very high concentration of Cr (3200 mg/L) into the waterways (Thiagarajan and Bolan, 1996). Contamination of soil from tannery and timber treatment plants with Cu, Cr, and As exceeding the threshold limits has been reported in New Zealand (Table 1). Thiagarajan (1997) has examined the transformation of Cr, Cu, and As added to soil and observed that while most of the trivalent Cr and Cu ions are retained onto the cation exchange sites, Cr added as hexavalent ions and As are liable for leaching. Leaching of Cu, Cr, and As through some free-draining soils of New Zealand was examined by Carey *et. al.* (1996). They concluded that the high metal concentration in the CCA solution and the decreased contact time between the solute and the free draining soils are likely to result in an enhanced movement of heavy metals to ground water.

The threshold limits for Cu, Cr, and As in soils vary depending on the nature of the land use (Table 2). The threshold limit gives the maximum permissible level for the legal input of heavy metals into the soil. The threshold level for Cr (VI) is very low compared with that for Cr (III) due to the high mobility, carcinogenic, and phytotoxic characteristics at very low concentration in soil of the former.

5 Removal of Heavy Metals From Industrial Effluents

Chrome tanning wastes from the tanning processes contribute approximately 5 kg of Cr per 1000 kg of hide. Similarly the wastes from timber treatment processes contribute approximately 1-5 kg Cr (VI), Cu, and As per 1000 m^3 of timber treated. These heavy metals can be removed from the industrial effluents by various methods that include precipitation, ion exchange, electrocoagulation, microfloatation, electrolysis, alum coagulation, and carbon adsorption. The main processes involved in reducing the heavy metal concentration in industrial effluent are discussed briefly.

5.1 Precipitation

Precipitation is the most commonly used commercial method to remove heavy metals from industrial effluents. Removal of Cr (III) from industrial effluent is achieved using lime or magnesium oxide to precipitate as chromic hydroxide. The spent tanning solution is discharged into a precipitation tank equipped with a stirring mechanism for mild, non-turbulent mixing. By the addition of lime or magnesium oxide the solution in the precipitation tank is brought to a pH of about 8-9 at which pH the Cr will precipitate as chromium hydroxide. The separation of precipitated Cr from the solution is usually done by decanting the supernatant liquid using a series of cocks and the chromium hydroxide slurry left at the base of the tank is pumped into a recycling tank. Chromium can be recycled

Table 1. *Concentration of Cu, Cr, and As at tannery and timber treatment (CCA) effluent contaminated sites in New Zealand.*

Location	Source	Range of Soil Levels (mg/kg soil)			Reference
		Cu	Cr	As	
Bay of Plenty	CCA	108-6300	140-11000	80-10950	McLaren (1992)
North Island	CCA	326-8020	428-4100	376-10440	Armishaw *et. al.* (1993)
Canterbury	CCA	2100	2800	6100	CMPS & F (1995)
North Island	Tannery	-	14-3670	-	Thiagarajan (1997)

Table 2. Threshold levels (mg/kg) for selected tannery and timber treatment chemicals in soils (Ministry for the Environment/ Department of Health, 1992).

Contaminant	Agricultural	Residential	Industrial			Maintenance
			Unpaved	Paved		
				Unmanaged	Managed	
Arsenic	10	30-100	300	450	1500	450
Chromium (III)	600	600	-	-	-	-
Chromium (VI)	10	50	350	550	1750	550
Copper	30-100	130	-	-	-	-

after precipitation. The chromium hydroxide slurry can be dissolved easily in acid (sulfuric acid) and the separated Cr can be recycled.

Reduction of Cr (VI) to Cr (III), and subsequent hydroxide precipitation of the trivalent chromic ion, is the most common method of treating Cr (VI) contaminated industrial effluent. The standard reduction techniques is to lower the waste stream pH to 2-3 with sulfuric acid, and convert the Cr (VI) to Cr (III) with a chemical reducing agent, such as sulfur dioxide, sodium bisulfide, metabisulfite, or ferrous sulfate. The Cr (III) is then removed, usually by hydroxide precipitation.

Precipitation of Cu contaminated industrial waste is usually done using lime or sodium hydroxide at a pH of 9-10. Residual concentration of 0.2-1.1 mg/L has been achieved for Cu in the timber treatment effluent using lime precipitation. The primary mechanism for the removal of As is by precipitation as hydroxide using mostly lime. Arsenic can also be precipitated using sodium sulfide, ferric sulfate, ferric chloride, and alum.

5.2 Other Processes

Ion exchange treatment of Cr (III) contaminated effluent is the next preferred commercial treatment option after precipitation. A cationic type of resin is employed for removing positively charged ions Cr (III) and Cu (II). Anion exchange resin is employed to remove chromate and arsenate. The ion exchange capacity may be recovered by regenerating the resin.

The electrochemical reduction technique can be used to remove Cr (VI) in industrial effluents. It works on the principle that an electric current applied to an iron electrode results in the release of ferrous ions into solution. These ferrous ions then reduce Cr (VI) to yield Cr (III) ions. The Cr (III) ions are subsequently removed either by precipitation or an ion exchange process.

Various materials have been used to remove Cr from the industrial effluents. These materials include agricultural wastes (Orhan and Buyukgungor, 1993), powdered leaves (Suseela *et. al.*, 1987), *Pinus sylvestris* bark (Alves *et. al.*, 1993), and activated carbon (Sharma and Forster, 1996). A number of Cr accumulating plants, such as water weeds, and sunflower (Kumar *et. al.*, 1995) have been found to be effective in reducing Cr concentration in industrial effluents.

Ion exchange is capable of achieving high levels of Cu removal. Ion exchange resins, such as high molecular weight organic chelates are used in this process. Granulated activated-carbon treatment and electrodialysis have been reported to reduce Cu from wood chemical wastewater (Carwley, 1980). Activated alumina has been used to adsorb As from industrial wastewater (Nriagu, 1994). Desalting techniques, such as reverse osmosis and electrodialysis, and ion exchange can also be used to remove As from industrial effluents.

Thiagarajan (1997) has developed a technique to remove all the heavy metals from the tannery and the timber treatment effluents. In this technique the effluent is passed through two columns containing *Pinus radiata* bark and an industrial by product, fluidised bed boiler ash (FBA). The bark in the first column adsorbs some of the Cr (III), Cu, and As in the effluent and also reduces Cr (VI) to Cr (III). The alkaline FBA in the second column results in the precipitation of all the three heavy metals.

6 Remediation of Heavy Metal Contaminated Soil

A number of options involving on-site (or *in situ*) and off-site techniques are available for remediating heavy metal contaminated soil. The choice of the options depend on the extent of the pollution, the nature of the contaminants, the type of soil, the characteristics of the site, the relative cost of operation, and the regulations which apply in the country or region where the contaminated site is located. The degree of remediation varies from the minimum of reducing the bioavailability of the contaminants, to the maximum of either complete clean-up of the soil, or its removal from the site.

6.1 On-site Treatment

The on-site or *in situ* treatment involves the remediation of soil without excavating from the contaminated site. The *in situ* treatment can be achieved through physical, chemical, and biological treatment processes.

The major physical *in situ* treatment technologies in practice are physical mixing, soil washing, and solidification. Physical mixing can be achieved by importing clean soil and mixing with the contaminated soil (Musgrove, 1991). This method is not a preferred option because the total contaminant loading of the site remains the same. Soil washing is based on the desorption or dissolution of metals from the soil inorganic and organic

matrix during washing with acids and chelating agents. The high cost of chelating agents and choice of extractants make this technology an unsuitable option (Clijsters and Vangronsveld, 1994). Solidification involves the stabilisation of the contaminated soil into a solid mass using cement, fly ash, gypsum, asphalt, or vitrification and has been applied in field scale remediation. Blast furnace slag-modified grouts were used for *in situ* stabilisation of Cr contaminated soil (Allan and Kukacka, 1995).

Various agents have been used to immobilise heavy metals chemically. Chelate ion exchange resin, cation exchange resin, hydrated lime, ferrous sulfate and silica gel, and natural resources, such as bentonite clay and green sand have been found to be effective in the immobilisation of a range of heavy metals. Few chemicals, such as ferrous sulfate are used to reduce Cr (VI) to Cr (III) and then precipitate Cr as chromium hydroxide. Commercial surfactants, such as Dowfax 8390 are effective in remediating subsurface Cr contamination. Thiagarajan (1997) observed that the addition of FBA and lime to soils treated with Cr (III) and Cr (VI) has been found to be very effective in immobilising the heavy metal. Similarly the application of organic amendments, such as cow dung, bermuda grass, pinus bark, and yeast extract have been found to be effective in the reduction and immobilisation of Cr (VI) contaminated soil (Cifuentes *et. al.*, 1996; Thiagarajan, 1997). A major inherent problem associated with immobilisation techniques is that although the heavy metals are less bioavailable, the contaminant concentration remains unchanged. The immobilised heavy metal may become plant available with time through the natural weathering process.

Phytoremediation is an emerging technology for remediating contaminated soil. It involves the use of metal accumulating plants and requires the translocation of heavy metal from the soil to the easily harvestable plant parts which may be later harvested, dried and isolated as hazardous waste (Kumar *et. al.*, 1995).

6.2 Off-site Treatment

Off-site soil treatment involves the removal or destruction of the contaminants in the soil. The excavated soil can be treated before it is brought back to the site or disposed off in the disposal site. The contaminated soil from the site can be removed and replaced with a clean imported soil. The contaminated soil is stored in a safe place for further treatment. Mostly the contaminated soil is buried in a landfill. ANZECC/NHMRC (1992) guidelines suggest that soil removal may not continue to be an appropriate option due to the potential hazard associated with the transport of contaminated materials to the landfill site, contaminant migration from the landfill into adjacent environments in leachate, and future limitations on the availability of secure landfill sites.

7 Summary

- The tanning and the timber treatment industries are a major source of heavy metal pollution into soils and waterways. The tannery and timber treatment (CCA) effluents are enriched with toxic heavy metals, such as Cu, Cr, and As.

- Chromium occurs as trivalent (III) and hexavalent (VI) ions in tannery and timber treatment effluents, respectively. Hexavalent Cr is more mobile and toxic than the trivalent ion. In CCA solution, As is present as arsenate (AsO_4^{3-}) and Cu as Cu (II).

- Heavy metal pollution from tannery and timber treatment effluent is often found to exceed the threshold levels for soils in New Zealand.

- For both tannery and timber treatment effluents, precipitation seems to be the most suitable and preferred method for removing heavy metals. But Cr (VI) present in timber treatment effluent should be first reduced to Cr (III) before precipitation.

- Various methods are available to remediate heavy metal contaminated soil.

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Dr Nanthi Bolan graduated in soil science from the University of Western Australia and is currently working as a Senior Lecturer in the Department of Soil Science at Massey University. He has 18 years of research experience and his present research areas include transformation of contaminants (heavy metals and pesticides) in soils, removal of pollutants from industrial and farm effluents, use of slow release phosphate and sulfur fertilisers in pasture, and evaluation of industrial byproducts as soil amendments. He is presently on the editorial board of an international journal on 'Nutrient Cycling in Agroecosystem'. He has published more than 70 research papers in scientific journals and has presented a number of papers at national and international conferences.

WASTE NOT WANT NOT!

Part 1. Food Packaging - Technology and the Environment

Sarah Donnelly[*], *Allan Easteal*[**] *and John Hay*[***]
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Packaging has generated an inordinate amount of attention from a multitude of sectors and interest groups. A result has been much misunderstanding about the effects of packaging on the environment. A widespread opinion is that much packaging is unnecessary or excessive. For the most part, however, this view neglects the multiple benefits provided by packaging. This paper explores packaging issues from a New Zealand perspective, outlining the benefits of packaging, reviewing recent trends, and describing the environmental impacts associated with use of packaging. Industry initiatives to minimise these impacts are also identified. The area of focus is the food-packaging sector, where the technology of package design is at its forefront.

Benefits of Packaging

To minimise environmental impacts of packaging, an option is to use no packaging at all. Unfortunately, viable solutions are less simplistic. It is wise to remember that packaging has numerous benefits, the most obvious being a reduction in food spoilage. Studies have shown that due to adequate packaging and distribution processes, the loss of food products between producer and consumer is 2% in the developed world, compared with up to 33% in the developing world (Wessling 1977, cited in Packaging Environmental and Advisory Group 1996). Decreases in food wastes are correlated with increases in packaging use (Bickerstaffe and Barrett 1993). Functions of packaging can be loosely grouped under the headings of communication, convenience, and protection:

- ***communication***: This encompasses both the product labels and shape/size of the package. Manufacturers are often reluctant to change package design, as customers tend to associate a particular product with the appearance of its package (Selke 1991, 1994). The main types of information which may be contained in a package are the identity of the product, ingredients, manufacturer, weight, and additional information such as recipes and instructions. An emerging international trend is ecolabelling[1] (Packaging Environmental and Advisory Group (PEAG) 1996).

- ***convenience***: Packaging can be designed for convenience by assisting consumers, with dispensing or application of the product (including 'childproof' or 'easy open' options) and aiding retailers in product display or sale (Ministry for the Environment 1987). Packaging can also help ensure consumer safety through use of 'tamper evident' features.

- ***protection***: For food products, protection is provided either by the package itself, or by controlling the atmosphere the product and package occupy. Packaging requirements for pre-processed products are more complex than those for unprocessed products. As well as providing physical protection, benefits can include extending the shelflife of the product, prevention of exposure to microorganisms, protection against water absorption, light and exposure to oxygen and loss of carbon dioxide, flavour and vapours.

Market Trends

A number of social and economic factors are playing a part in the packaged food market. Almost all foods can now be safely prepacked and stored for long periods of time. Single person households are increasing. This has created increased demand for smaller food packages. Other factors include the changing work regime, which has limited the time that people are willing to spend in meal preparation (Foster and Valenti 1996). Packaging is also changing to meet cooking requirements for conventional and microwave cooking (Foster and Valenti 1996). There has been a growth in sales of ambient, chilled and fresh products that require an oxygen barrier for a longer shelflife (Anon. 1995). The overall trend is that of an increasing demand for convenience food, and the packages of choice for such foods are primarily non-recyclable multilayer plastics or composites (Hanlon 1994). These packages are also preferred by manufacturers, for economic reasons due to their light weight (Foster and Valenti 1996).

New developments in food packaging films are generally aimed at enhancing physical integrity and barrier properties (Ooraikul 1991). The design of food packaging films must consider public heath and safety requirements as a priority (Packaging Environmental and Advisory Group (PEAG) 1996). Two emerging developments in food storage are controlled-atmosphere packaging (CAP) and modified-atmosphere packaging (MAP). CAP involves maintaining precisely defined and controlled environmental conditions (Ooraikul and Stiles 1991; Park *et al.* 1994b). It is used commercially to extend the shelflife of many fruits and vegetables but involves high capital and maintenance costs (Park *et al.* 1994b). MAP involves packaging the product in an atmosphere which has been modified so that its composition is other than air: packaging materials are tailored to meet the specific demands of the food product (Park *et al.* 1994a). Unfortunately, development and application of

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[1] Labelling on a package to provide information on the environmental impacts of the packaging and contents and/or appropriate measures of reuse, recycling or disposal (PEAG 1996).

the majority of MAP processes "*continue to add to the solid waste disposal problems associated with packaging wastes*" (Ooraikul 1991).

Basis of Concern

The New Zealand Resource Management Act (1991) legislates a duty to promote the sustainable management of our natural and physical resources by avoiding, remedying, and mitigating adverse environmental effects. Although some of the negative attention directed at packaging may not be justified, each stage in the life-cycle of a package has associated environmental consequences. To be meaningful, any comparison of different packaging materials, or design of a new product involves a life-cycle assessment[2]. An entire life-cycle assessment of a package is beyond the scope of this paper: a review of impacts at each stage in the life of a package is provided in the discussion document "*Packaging in the New Zealand Environment - Issues and Options*" (Ministry for the Environment 1987). The two issues considered below are resource consumption and waste generation:

Resource consumption encompasses all uses of raw materials and energy, and is an issue receiving a great deal of attention worldwide. For non-renewable resources, research into alternatives must be afforded a high priority, as even with the most efficient management, stocks will diminish (Cronin 1988). There must, be, eventually, a transition to renewable resources. Plastics have shown the most rapid growth of any packaging material (Cage 1993). Today there are six major types of plastics used for packaging, with an increasing number of composite materials. The raw material source for producing plastics is crude oil (a non-renewable resource). How long stocks of fossil fuels such as crude oil will last is unclear, but estimates are in the range of half to two centuries (Anon. 1997). Other packaging materials include glass, metal (steel, tin and aluminium), and celluloses (paper and wood). Figure 1 shows the consumption of domestic packaging materials in New Zealand in 1994. For a summary of the availability of raw materials used for packaging, the interested reader is referred to the document "*Packaging and the New Zealand Environment*" (Ministry for the Environment 1989, p12).

Other impacts associated with resource consumption are despoiling of the environment and pollution associated with extraction methods and processing operations.

Many consider the principal environmental issue facing the packaging industry to be *waste generation.* Waste generation, at all stages of production and consumption, has environmental

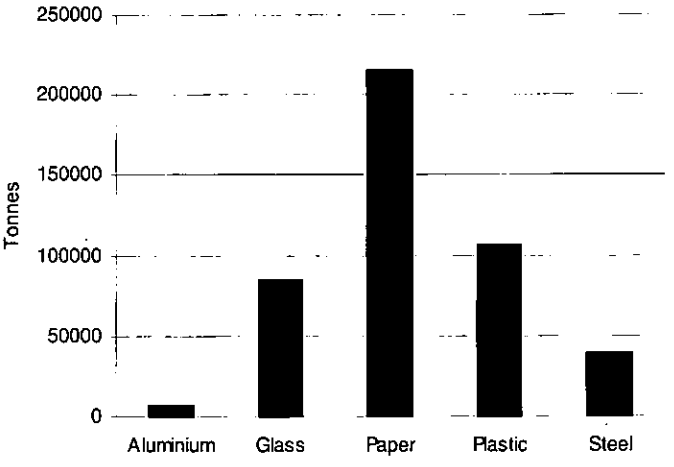

Figure 1. *New Zealand Domestic Packaging Material Consumption, 1994 (data from Packaging Industry Advisory Council 1996a).*

effects. Approximately 2.7 million tonnes of wastes enter landfills in New Zealand each year (PEAG 1996). While disposal by landfilling under well engineered and effectively managed conditions can be environmentally acceptable (Auckland Regional Council 1995), a major problem is the threat of overloading the system. This could be the consequence of an ever increasing quantity of solid waste produced, in combination with decreasing availability of sites (Goddard *pers. comm.* 1995). Reducing the amounts of wastes entering landfills can be motivated by economic factors, given that waste disposed of can be regarded as resource loss.

A survey of the packaging component of New Zealand waste streams was recently initiated by the Packaging Industry Advisory Council. Results indicated that packaging wastes make up around 12% by weight of the total municipal waste stream[3,4]. This figure is at the high end of overseas data, where packaging components range from 7-12% (PEAG 1996). Although the proportion of wastes arising from food packaging and non-food packaging sources was not quantified in this survey, overseas reports estimate food packaging wastes to comprise approximately two-thirds of total packaging wastes (Selke 1990).

In 1995 a pilot study was carried out on the refuse disposed of by twenty households in the Auckland region during a one week period, to analyse the plastic packaging component of household waste[5]. The plastic packaging component was divided into secondary plastic type, in accordance with the New Zealand Plastics Waste Classification Code (Ministry for the Environment 1992). The composition was confirmed by Differential Scanning Calorimetry (DSC) and Infra-Red (IR)

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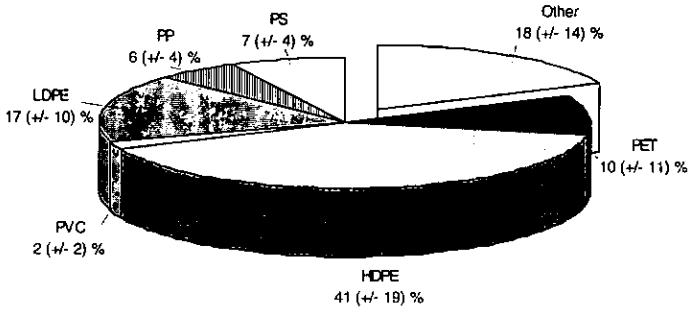
[2] An analytical tool to aid in making environmental decisions, and involves the assessment of different environmental impacts of a package at each stage of its life, including extraction, manufacture, transport, reprocessing and ultimate disposal (Bickerstaffe and Barrett 1993). The results of life-cycle assessments can be used in a variety of ways, including: the comparison of different materials options for a particular product; the identification of opportunities for improving the environmental performance of a product or process; and the comparison of different waste disposal or recycling options (Beevers 1993).

[3] In the same survey, it was found that increases in waste disposal volumes are implicitly linked with economic activity. This information can be used to predict changing waste trends (Packaging Industry Advisory Council 1996a).

[4] In almost all waste analysis surveys units are based upon weight. The impact of packaging on the waste stream cannot be judged primarily by weight, as often these materials inherently possess a high volume to weight ratio, a disadvantage from a landfilling perspective (Economic Commission for Europe 1992).

[5] This encompassed all plastic packaging materials, not those exclusively used for food packaging purposes.

spectroscopy analysis. Due to the small sample size (a total of 1194 items were counted), results obtained from this pilot study are at best indicative. Results are shown in Figure 2.



Abbreviations: PET Polyethylene Terephthlate; HDPE High Density Polyethylene; PVC Polyvinyl Chloride; LDPE Low Density Polyethylene; PP Polypropylene; PS Polystyrene.

***Figure 2.** Composition of Plastic Packaging Wastes[6].*

A notable finding in this survey was the size of the 'other' component of the plastic wastes (i.e. those plastics which are not classified as one of the six thermoplastic types). This component comprised 18% of the total, and was predominantly packaging for pre-processed food applications. DSC analysis revealed a large proportion of multilayered materials (for example, a 'bacon pack' comprises one layer of polyethylene, and one layer of nylon). This is an area of concern due to the difficulty in recycling these items, and lack of information concerning products formed during incineration.

An additional environmental impact of packaging is litter. Litter is a form of visible pollution, of which packaging comprises 45% of total items (PEAG 1996). It is detrimental to the quality of environment, and can prove harmful to wildlife (especially marine) through entanglement or ingestion (Nir 1990; Omichi 1992; PEAG 1996; Stevens 1992). This is especially true of plastics, where their durability and resistance to degradation equates to persistence in the environment. It must be remembered, however, that people are the cause of litter, not packaging itself.

Initiatives to Minimise Environmental Impacts

Recycling initiatives have had an impact by reducing the amount of packaging being disposed of in landfills. There is a concern, however, that recycling can simply shift environmental problems from one medium to another. Barriers to recycling schemes include fluctuating virgin material costs and reliance on consumer participation. These problems are exacerbated by New Zealand's geographically spread population (Plastics Environmental and Advisory Council 1995).

One of the considerations by the World Trade Organisation's Committee on Trade and the Environment is the "*relationship between the provisions of the multilateral trading system and requirements for environmental purposes relating to products*" (Organisation for Economic Co-operation and Development (OECD) 1994). The major areas in which eco-packaging[7] initiatives can affect international trade are waste minimisation practices which effectively favour locally produced packaging. PEAG (1996) comment that any local initiatives towards minimising packaging wastes must be consistent with international trade agreements. For this reason, local industries are reluctant to impose requirements which involve trade restrictions (Bartle *pers. comm.* 1996).

The New Zealand packaging industry has produced a voluntary Code of Practice, which consists of a set of guidelines to aid package manufacturers in ensuring that packaging has minimum net environmental impact, whilst preserving the integrity of the product it contains (Packaging Industry Advisory Council 1996b).

An international trend is a move towards adopting the ISO 14,000 series of environmental standards[8] (PEAG 1996). This has implications when considering changes in existing packaging design.

Summary

Reducing the adverse environmental impacts of packaging is not a matter of 'using less', or 'changing back' to simpler materials. Packaging requirements for processed food applications are complex, and the synthetic materials available are able to offer an ever improving range of functions, which we as consumers take for granted. Although some of the functions offered by synthetic packaging are in conflict with environmental concerns, they must be acknowledged when considering changes in package design.

Of the plastic packaging component of household waste, a considerable proportion is multilayered materials. This is a concern due to difficulties in recycling and disposing of these materials. In addition, more information is needed to identify any byproducts formed during incineration of the package.

According to a recent survey, packaging comprises 12% by weight of the New Zealand municipal waste stream. Despite its high visibility, these statistics show packaging may not be the environmental villain it is often portrayed to be. There is, however, room for improvement. New Zealand industries recognise this, and have thus produced a voluntary Code of Practice, aimed at reducing environmental effects.

Much of the misunderstanding about packaging results from inaccurate assumptions by the consumer. The food packaging industry needs to consider adverse environmental effects when designing new products. For their part, the consumer must recognise that viable solutions to reduce actual environmental effects are not as straightforward as they may first appear.

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[6] Figures in parenthesis are uncertainties at the 95% confidence interval, and were calculated from guidelines provided in the New Zealand Waste Analysis Protocol (Ministry for the Environment 1992).

[7] A phrase which covers trends and developments in the packaging industry to provide packaging which is "more environmentally acceptable" (OECD 1994).

[8] The International Organisation for Standardisation (ISO) is the world body for establishment of standards. Series 14,000 applies to environmental issues (PEAG 1996).

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ABOUT THE AUTHOR

Sarah Donnelly graduated from the University of Auckland in August 1997 with a joint MSc degree in Environmental Science and Chemistry. Her thesis involved developing edible films for potential use as packaging materials. Since completing her degree she has completed an internship with the United Nations Environment Programme. Currently Sarah is working in the Forensic Science Laboratory at the Institute of Environmental Science and Research Limited, Mt Albert Science Centre, Auckland.

Patent Proze

by Jane Calvert and Greg Lynch

Erratum

The editor advises that in the fourth paragraph of the previous *Patent Proze* in *Chemistry in New Zealand* 61, 6, the "symbol R" and "symbol T" were intended to read "symbol ®" and "symbol ™", respectively. Apologies to the authors and to readers for any confusion caused.

CHALLENGING ANOTHER'S INVENTION - OPPOSITION AND REVOCATION PROCEEDINGS

In previous issues of *Patent Proze* we have focused on what is required to secure patent protection. However, the validity of a patent application or a patent can be challenged. A challenge to the forthcoming grant of a patent occurs by way of opposition proceedings. Revocation proceedings are used to challenge a granted patent.

Opposition Proceedings

Following acceptance of a patent application, and advertisement of this fact in the New Zealand Patent Office Journal, a window of three months is open for any person interested to file a notice at the Intellectual Property Office of New Zealand (IPONZ) opposing the grant of the patent. This notice begins the opposition proceedings. Nearly all applications in New Zealand proceed to grant unopposed.

The notice of opposition must outline one or more grounds as to why the patent application is considered not entitled to proceed to grant. The grounds of opposition are specified in the Patents Act 1953 and are more comprehensive than the grounds of objection which may be raised against the application by an examiner at IPONZ during technical examination. The grounds that can be used to oppose the grant of a patent include:

- prior publication or prior use of the invention in New Zealand before the date on which the patent application was filed
- that the invention is obvious in light of what was published or used in New Zealand before the filing date
- that the applicant of the patent application obtained the invention and filed the application without authority

We hope to expand on these and other grounds in future issues of *Patent Proze.*

Evidence to support the grounds that are relied upon in opposition must be prepared and lodged at IPONZ. The applicant also presents evidence in reply. Both parties have the opportunity to review all the evidence. If the matter remains unresolved, a hearing before the Commissioner of Patents is conducted where both the applicant for the patent and the opponent have the opportunity to present their arguments. The Commissioner then decides the outcome of the opposition on the basis of the evidence and arguments presented at the hearing and provides a decision in writing.

The opposed application will then proceed to grant if the opposition against the application has been unsuccessful. Alternatively, if the opposition has been successful, the Commissioner may refuse to grant the patent or may allow the applicant to make amendments to the patent specification to rectify the matter. Any opposition decision of the Commissioner of Patents may be appealed to the High Court.

Revocation Proceedings

If an interested party wishes to challenge a granted patent, the mechanism is revocation proceedings. Revocation proceedings may be initiated at any time during the lifetime of a patent. However, if revocation is applied for within twelve months of grant of the patent, the interested party has the option of seeking revocation either before the Commissioner or before the High Court. Revocation before the Commissioner is also known as belated opposition as the grounds available are identical to those available for opposition proceedings. The procedure is also the same as for opposition proceedings. The Commissioner's decision can be taken on appeal to the High Court.

If revocation proceedings are not initiated within twelve months of the grant of a patent the revocation proceedings may only be

Jane Calvert

Jane Calvert and Greg Lynch are both employed in the patent department of Baldwin, Son and 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 Limited in Wellington. Following completion of a PhD in chemistry at the University of Otago in 1989, he spent a two year period as a postdoctoral researcher at Oxford University in the United Kingdom.

Greg Lynch

heard by the High Court. The revocation grounds are more extensive but similar to those grounds which are available for opposition. Again, the grounds are specified in the Patents Act. While any opposition or revocation proceedings can take several years to achieve a result, actions brought before the Court usually take longer than those brought before the Commissioner because of more complex procedures before the Court. Revocation proceedings that are taken to the High Court cost substantially more than revocation proceedings heard before the Commissioner.

There are two common ways whereby the existence of a patent or patent application becomes known and sparks a validity challenge. The first arises by regularly monitoring the monthly Patent Office Journal. Those concerned with new activities of others, especially market rivals, are likely to monitor the Patent Office Journal for inventions which may encroach on their own or other existing technologies. The second way arises when an action for infringement of a patent is brought by the patentee. Often the party being sued for infringement will counter by seeking to revoke the patent.

Please forward any queries to:
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International News

IUPAC STRATEGIC INITIATIVE IN MATERIALS

IUPAC has commenced a strategic initiative in materials, to coordinate new and existing projects on materials science which require expertise from more than one IUPAC Division, and to act as a worldwide point of reference for issues related to materials science and IUPAC.

The working group of this initiative is co-chaired by Professor John Corish (IUPAC Inorganic Division, Trinity College, Dublin) and Professor Robert Gilbert (IUPAC Macromolecular Division, University of Sydney). The first meeting was held at the IUPAC General Assembly in Geneva in September 1997, with members of the Physical Chemistry, Inorganic and Macromolecular Divisions. The IUPAC commissions involved thus far are Commission I.6 (colloid and surface chemistry including catalysis), Commission II.3 (high temperature materials and solid state chemistry), and Commissions IV.1 and IV.2 (macromolecular nomenclature and polymer characterisation and properties).

New projects are being considered involving measurement, characterisation and nomenclature in: colloidal stability and flow, characterisation of powders, nano-structured materials, electro-active polymers; porous materials, new layered materials, inorganic composites; bio-mimetic materials, combinatorial synthesis of inorganic materials, organic templates for inorganic zeolites, atomic-layer epitaxy, joining, advanced materials manufacture, and thermal and thermomechanical properties of composites.

Another important area will be in education involving materials chemistry, for example creating a resource on the worldwide web of current syllabi in materials courses.

The Co-Chairs have issued a call for expressions of interest for interdivisional materials-related projects, and proposed outcomes from such projects. Expressions of interest should be sent to the Co-Chairs:

Professor John Cornis
Email: JCORISH@tcd.ie

Professor Robert Gilbert
Email: gilbert@chem.usyd.edu.au

IUPAC WEB SITE

A revised and updated IUPAC web site is now available. The url is http://www.iupac.org/.

Some of the information on the site has not yet been updated. The updating process is of course never ending, however, I expect that the seriously outdated material will be changed by the end of the month.

IUPAC would greatly appreciate any comments on how the value of the site as an information resource and communication tool for participants in IUPAC activities and the global chemistry community could be improved. Email: IUPAC@interpath.com

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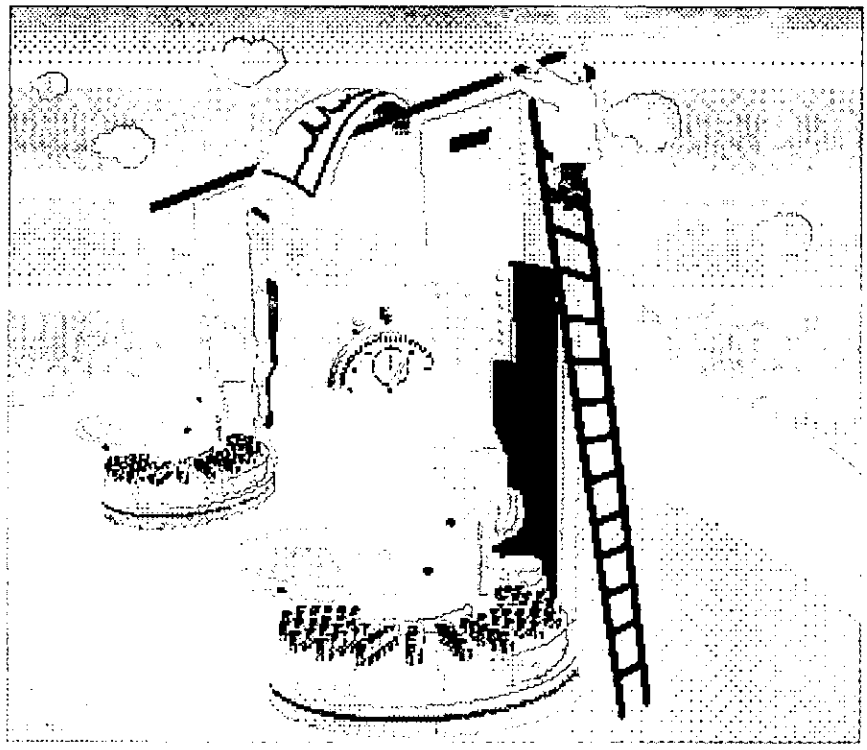

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Gas Chromatography and GC-MS Focus Feature

USER SURVEY DICTATES DESIGN OF NEW VARIAN GAS CHROMATOGRAPH; EASE OF USE TERMED PARAMOUNT

New User Interface Minimises Costly Training; Enhances Productivity

A.i. Scientific is pleased to announce the release of the next generation gas chromatograph from Varian, the Model 3800 GC, an instrument it considers the easiest to use and most versatile of its kind ever developed. The specifications of the 3800 GC were determined in large measure by conducting a thorough survey of the working needs of a wide cross-section of chromatographers.

"Hundreds of laboratory managers, directors, and chromatographers provided input for the design of this instrument," said Varian Executive Vice President Allen J Lauer. "There was considerable agreement in the fundamental design of the 3800 GC deriving from the fact that 'productivity' is the industry's universal catchword. Consequently, our product innovation efforts focused on the 3800 GC's ease of use, performance, and reliability. These factors add up to increased laboratory productivity," Lauer said.

The 3800 is strongly suited for both routine and complex sample analyses in basic chemical industries, petroleum and petrochemical processing applications, food and beverage analysis, environmental studies, as well as pharmaceutical research and processing.

Innovative User Interface, Network Ready

One of the keys to productivity is a logical, easy user interface, which can minimise extensive and expensive training. For gaining rapid familiarity, the rugged 3800 GC features an intuitive keyboard with fewer keys to lead the user through an analysis. A front panel display with up to eleven lines of information, by far the industry's largest and most helpful, allows easier method building and viewing of instrument status.

Standard Ethernet connections make the Model 3800 a fully network-ready GC. Direct network connectivity ensures convenient, cost-effective integration into existing laboratory computer networks. As a result, the instrument can be accessed from virtually any point on a laboratory network without cumbersome cabling and mission critical data can be managed more easily.

The 3800 GC offers precise electronic or manual gas flow control. Electronic flow control (EFC) helps improve the quality of analytical data by reducing operator error and making it easier to reproduce results. Varian has designed the EFC such that it can be optimised specifically for each inlet type including valved applications, and cost savings using EFC can be considerable, as much as the cost of a new 3800 GC over a three-year period.

Detectors, Injectors, Arid Sample Preparation

A full suite of universal and selective detectors can be controlled using FID, TCD, ECD, TSD (N, P), PFPD (S, P, N, C, metals), and ion trap MS. Additionally, the system is ideal for custom solutions with seven powered relays available for external devices. The 3800 GC has seven independently heated zones, built-in catalyst systems, and a new valve oven that can accommodate six valves, which are critical to many petroleum applications.

The new 1079 universal capillary injector increases sensitivity optimises analyte recovery, and allows maximum flexibility with five modes of injection: split, isothermal spitless, temperature ramped spitless, on-column, and large volume. The 1079 can operate at temperatures up to 450 °C, which is particularly important for the analysis of high-temperature petroleum crude oils and waxes.

In-field modifications are simplified through accessible front-mounted pneumatics and colour-coded PEEK tubing. For added productivity, the 3800 GC also supports a complete range of GC automation and sample preparation techniques for every sample type including the 8200 AutoSampler, automated solid phase microextraction, heated headspace, and purge and trap with the Archon autosampler.

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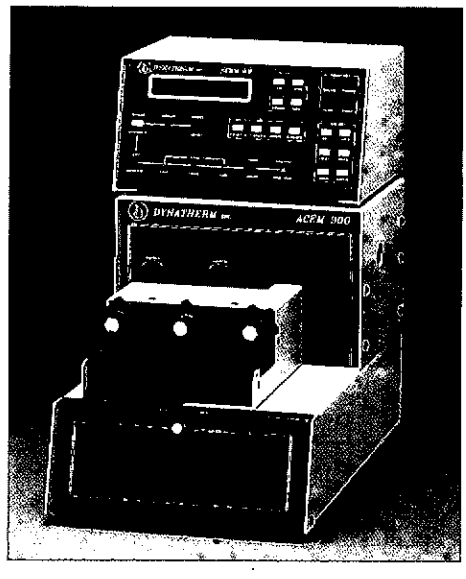
ACEM 900 THERMAL DESORPTION SYSTEM



Concentrate and inject volatile materials onto your existing system.

- Functions as a concentrating inlet for GC and GC/MS.
- Interfaces easily to an existing GC via a heated transfer line.

- Eliminates sample preparation steps that use solvents.
- Makes large volume injections easy.
- Interfaces with collection bags and Summa cannisters for gas sampling.

The ACEM 900 Thermal Desorber is an alternative inletting system for GC and GC/MS that interfaces easily to existing GCs. This unique system collects, concentrates, and efficiently injects volatile materials into a capillary GC. For example, as a concentrator it traps litres of air samples in a sorbent tube, transfers the analytes to a focusing trap and desorbs it with a few millilitres of carrier gas - yielding a thousand-fold increase in concentration.

The process is simple. Analytes from a variety of matrices such as foods, soil samples, petroleum, etc. are collected and concentrated on an adsorbent material packed in a sorbent tube. The sorbent tube is placed in the ACEM 900 where it is purged by carrier gas, heated and backflushed to a patented secondary focusing trap. The smaller ID and reduced amount of adsorbent in the focusing trap concentrates the sample and allows rapid and complete desorption of the trap at flow rates compatable with capillary GC.

Using the ACEM 900 eliminates sample preparation steps and reduces hazardous solvent use. Analyte collection from a purge and trap or Dynamic Thermal Stripper eliminates solvent extractions when analysing for trace compounds in soil and water. No solvents are necessary to desorb collection tubes for typical industrial hygiene air sampling.

The ACEM 900 is a stand alone unit that is placed beside or on top of the GC. A heated transfer line makes a simple connection between the unit and the GC. This transfer line is lined with fused silica yielding an inert, non-adsorptive pathway for the analytes. The Thermal Desorber samples from collection vehicles such as Tedlar bags and Summa cannisters with an auxiliary Interface Module. The ACEM 900 also functions as a continuous monitor for volatile contaminants in ambient air by adding a vacuum pump.

The Thermal Desorber can also be used as an alternative to large volume injectors. Using an appropriate sorbent tube, a large volume injection is made onto the tube. After carrier gas purges away the aqueous or solvent matrix, the tube is placed in the desorber, heated, refocused, and desorbed to the GC.

Request your copy of Bulletin # 398 now.

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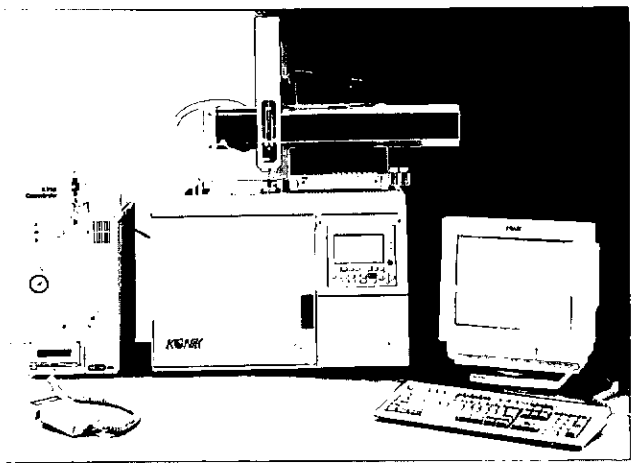
KONIK HRGC 4000A 20TH ANNIVERSARY SERIES

The Konik HRGC 4000A is the lastest generation of precision gas chromatography systems manufactured by Konik since 1978. 'Modularly Perfected' over the last 20 years, based on a 'unique normalised chassis' concept, the Konik 4000A has been designed to offer the best performance in the market and to satisfy any chromatographic application.



The unique features of the Konik HRGC 4000A are:

1. *New High Performance Oven:* stability ±0.01 °C, minimum thermal inertia, quick cooling time (from 250 °C to 50 °C in less than 5 minutes at room temperature).

2. *New Microprocessor (Intel) Controller* with a new LCD (240 x 180 points) screen, menu-driven, simultaneous visualisation of all relevant parameters, and user-friendly.

3. *Complete range of options:* Digital setting and programming of flow and pressure of carrier gas and all detector gases (EPC) optional, autosamplers, RS-232/RS-485, pyrolisers, head space, purge and trap, software, and multi-valve automation.

4. *Total modularity and flexibility:* This unique Konik modular design maintained over 20 years allows constant upgrading and equipment modernisation, as well as optimising the configuration to any and all analytical requirements. Lowest obsolescence in the market place.

5. *Versatility:* All injection systems, all detector options, all types of columns, and all types of peripherals control. Define your 'chromatographic analyser' at will. Easy to configure and reconfigurable.

6. *Low maintenance* due to its robustness and reliability. Easy to self-repair by the end-user by module/board exchange. Autodiagnostics.

7. *'Turn Key' analyser options:* Refinery Gas, Simulated Destillation, Fatty Acid and VFA Analysers and Water (EPA methods) Analyser.

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Email: konik@cecot.es
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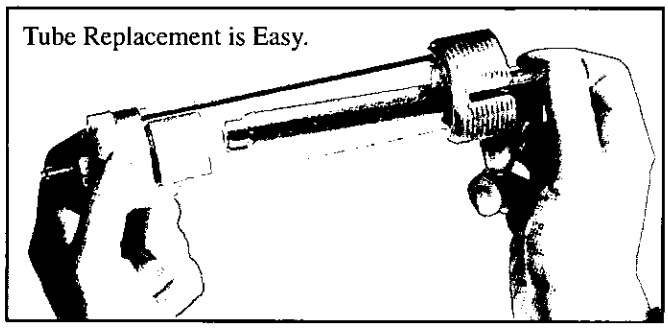
NEW OMI INDICATING PURIFIER

- Purifies helium, hydrogen, nitrogen, argon/methane.
- Colour change indicates purifier exhaustion.
- Glass body does not diffuse air or off-gas.
- Ideal for Hall, ECD and GC/MS detection systems.
- OMI-4 purifier protects multiple instruments (three times the capacity of OMI-2 tubes).

- Design prevents air from entering tube during replacement
- Irreversibly removes contaminants from carrier gas.

Simultaneously removes oxygen, water vapour, carbon monoxide, carbon dioxide, most sulfur compounds, alcohols, and phenols to less than 10 ppb. Install the OMI tube downstream from your primary gas purifying device, and tell at a glance whether or not oxygen and water are being effectively eliminated. As little as 1 ppm of oxygen or water will change the indicating resin from black to brown.

Spent tubes are easily replaced.



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Free Phone: 0800 936666, Free Fax: 0800 937777
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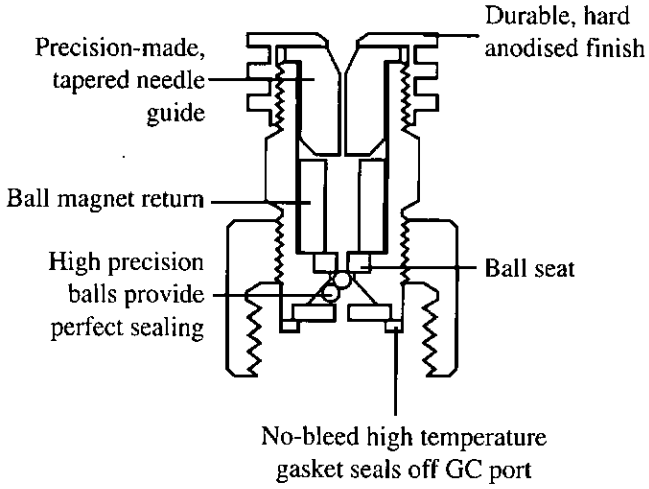
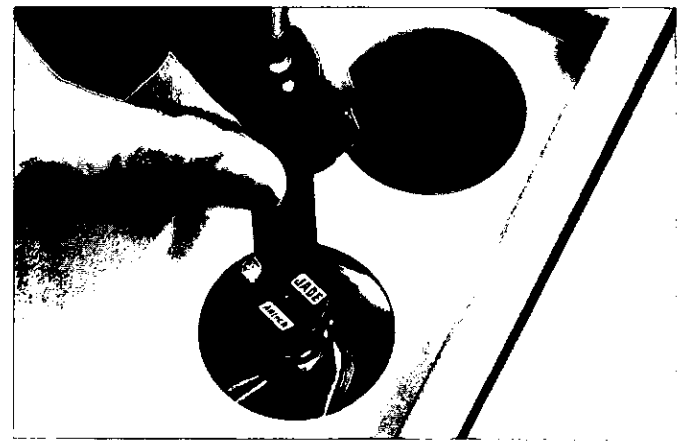
NEW! SPME VERSION OF THE JADE VALVE

A new SPME version of the JADE septumless GC injection valve is now available to make solid-phase microextraction more reliable. SPME is a sample preparation technique that uses a coated fibre as the adsorption medium for analytes. The fibre is enclosed in a sheath to protect it and the device operates like a syringe.

The JADE valve eliminates septa problems and makes sample desorption more consistent. A special needle guide sized to accommodate the fibre sheath of an SPME device allows the analyst to use the no-bleed, no-failure JADE valve septum-replacement injection system. It is possible to convert an existing JADE valve to a SPME JADE valve by changing the needle guide. Simply order part # 8081.

The JADE Valve





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HEWLETT PACKARD INTRODUCES RETENTION TIME LOCKING SOFTWARE FOR THE HP 6890 GAS CHROMATOGRAPHY SYSTEM

Hewlett Packard (HP) Company have introduced retention time locking (RTL) software, a powerful new productivity tool for the HP 6890 gas chromatography (GC) system.

RTL is an HP innovation that takes advantage of the outstanding retention-time reproducibility possible with HP's third-generation electronic pneumatics control (EPC). RTL allows capillary-GC users to reproduce chromatograms with the same retention times on different HP 6890 systems with EPC. Gas chromatography results are now independent of the GC configuration (e.g. inlet or detector), location or operator. RTL can also compensate for differences in nominal column length. Operators around the world can obtain the same chromatograms whether they are using an HP 6890 GC with a flame ionisation detector at atmospheric pressure, a mass selective detector at vacuum or an atomic emission detector at an elevated pressure.

The RTL software can be used by method developers to lock a method using a single compound (the locking compound) in their typical standard mixtures. The software establishes the relationship between the pressure and retention time. Once known, this relationship is used to lock the method on any HP 6890 GC system equipped with EPC.

To lock another system, an operator makes a single run using the standard and enters the retention time of the locking compound into the software. The software calculates the new inlet pressure required to match the chromatogram to the chromatogram obtained from the original HP 6890 GC system. The software also can update the method with the new pressure automatically. With RTL, calibrating capillary-GC retention times becomes as familiar as calibrating a UV-Visible spectrophotometer with holmium oxide or a mass spectrometer with PFTBA.

RTL Offers Many Benefits

RTL, which integrates seamlessly into the HP ChemStation for GC systems, provides the following benefits for customers performing capillary gas chromatography:

• *Fast and easy transfer of methods:* New GC methods typically are developed at one laboratory, then used at multiple sites. It is unusual for the systems to be exactly the same, especially column lengths. Without RTL, users at the remote locations have to modify calibration tables, timed-event tables and integration-event tables manually. With RTL, the method developer locks the method, and users simply run their usual standard to re-lock the methods on the different HP 6890 systems.

• *Greater confidence in results:* Since chromatograms are the same, regardless of instrument configuration or location, results can be compared quickly and easily. The excellent retention-time reproducibility of the HP 6890 GC system with EPC also allows users to set very narrow peak windows, allowing clear differentiation between closely eluting peaks and reducing the possibility of misidentifications.

• *Increased efficiency:* Faster method setup and transfer means more time can be spent running samples, which, in turn, may lead to faster decisions about process and product quality and faster time to market.

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HEWLETT PACKARD PUBLICATION DESCRIBES THE BENEFITS OF FAST GAS CHROMATOGRAPHY USING THE HP 6890 SERIES GC SYSTEM

Hewlett Packard (HP) Company has published a brochure brief (Literature 5966-0435E) titled 'High-Quality GC Results, Fast. It's Time.'

The publication outlines the benefits of performing fast gas chromatography (GC). It also describes how the HP 6890 Series GC system has everything needed to reduce analysis times by as much as ten-fold. The brochure includes information on how the HP method-translation software, available free on HP's Chemical Analysis Website, can be used to convert existing GC methods to fast GC methods quickly, easily, and predictably.

Chromatograms are included that demonstrate real examples of how the HP 6890 Series GC system was used to slash run times while maintaining the same elution order as the original method. A table highlights the standard features of the HP 6890 system, many of them exclusive to HP, that facilitate fast GC.

Information about HP chemical analysis products and services can be found on the World Wide Web at http://www.hp.com/go/chem.

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NEW GUIDE TO DERIVATISATION REAGENTS FOR GC

Many reagents are used to prepare derivatives for gas chromatography, but most of the derivatisation reactions fit into one of three categories: acylation, alkylation, or silylation. This bulletin describes each category and presents information on how to choose the proper reagent based on the functional group(s) of the compound to be derivatised.

Request Bulletin 909 available from Supelco.

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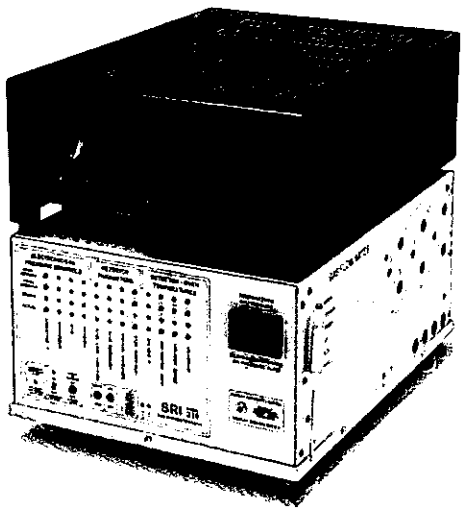
NEW SRI 310 GC
FULL-SIZE GC PERFORMANCE IN A COMPACT, EASILY TRANSPORTED PACKAGE.

- Smaller size than SRI 8610 GC.
- Multiple detector configurations.
- Temperature programmable oven.

The SRI 310 GC offers full-sized GC performance in the smallest practical size. At only 31.7 cm x 36.8 cm x 33 cm the SRI 310 GC is the smallest GC available that offers a 400 °C temperature programmable oven and multiple detector configurations. The 310 GC is especially suited for field applications, and comes with a rugged reusable plastic shipping container for transportation. The 310 GC can be equipped with up to 4 detectors (choose from 10 types) and up to 2 injectors, including a heated split/splitless and the new fast SPME injector. Valco valves and heated valve ovens are not easily mounted on the 310 GC's small chassis. The 310 GC's compact oven requires columns with a cage diameter of 125 mm or less.

To design your system simply choose the SRI GC chassis you wish to use along with at least one detector. If your analysis requires the use of small bore capillaries or if you wish an additional injector simply include the appropriate part number when placing your order.



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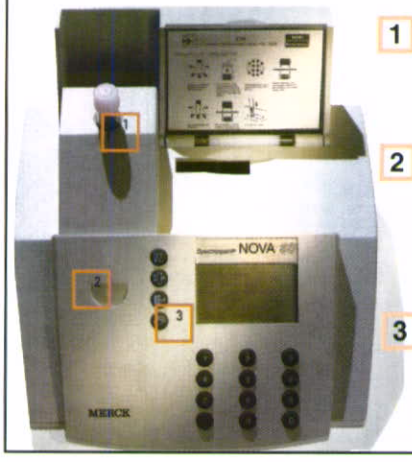

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3. The three QC modes help to ensure reliable analytical quality.

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- SPECTROSOL standards for AAS and ICP
- HIPERSOLV solvents for HPLC and pesticide residue analysis
- ANALAR reagents "There is a Difference" e.g. pH Buffers, AnalaR Water, ConvoL and AVS Standard Solutions

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- Chloride
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- Nitrate
- Sulfite
- Nitrite
- Lead
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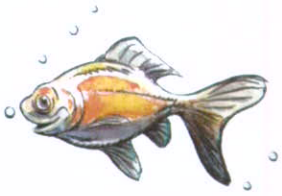

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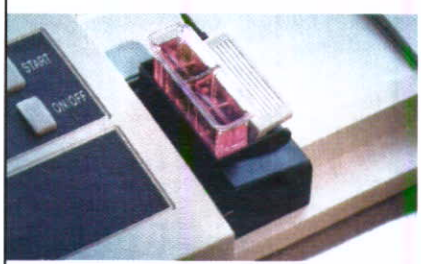

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HEWLETT PACKARD APPLICATION NOTE DESCRIBES PESTICIDE ANALYSIS USING LARGE-VOLUME INJECTION WITH THE HP 6890 SERIES GC AND HP 5973 MSD

Hewlett Packard (HP) Company has published an application note (Literature 5966-1214E) titled "Trace Level Pesticide Analysis by GC/MS Using Large-Volume Injection." The application note describes the analysis of pesticides in several food extracts using large-volume injection with the HP programmable temperature vapourising (PTV) inlet, an HP 6890 Series automatic liquid sampler, an HP 6890 Series gas chromatograph (GC) and an HP 5973 mass selective detector (MSD). The PTV permitted injection volumes as large as 100 µL, which allowed identification of several pesticides by scanning GC/MSD at the 100 ppt (100 ng/L) level. The PTV was able to tolerate dirty food extracts very well, with more than 1500 µL of such samples injected into a single PTV liner.

The publication also includes a brief tutorial on the use of the HP PTV for large-volume injections. The application note is available without charge from any Medtec office. Information about HP chemical analysis products and services can be found on the World Wide Web at http://www.hp.com/go/chem.

Contact: Peter Hermans, Medtec Products Ltd
Phone: (09) 4791068, Fax: (09) 4791450
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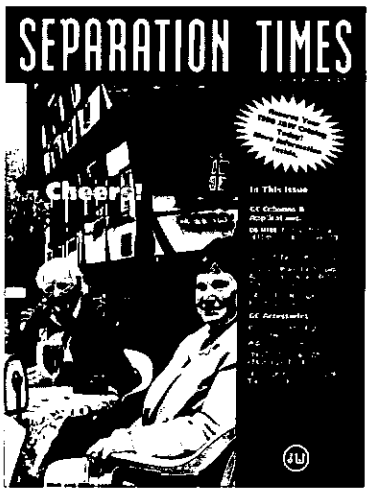
J&W SCIENTIFIC'S CO-FOUNDER TOASTS THE LATEST ISSUE OF *SEPARATION TIMES* MAGAZINE

J&W Scientific, the leading manufacturer of high resolution GC columns world wide, releases the latest issue of *Separation Times* (Volume 11, Number 3), highlighting new GC applications and accessories from J&W and featuring J&W Co-founder Walt Jennings and his wife on the front cover. This full colour, 16 page magazine offers chromatographers the latest in GC applications from J&W's experienced technical support chemists.



Two of the GC applications featured in this issue include:

- *DB-MTBE: Positive Identification of Methyl-Tert-Butyl Ether.*

This article examines the difficult analysis of underground storage tanks and ground water for the contamination of MTBE, a possible human carcinogen. The use of a special proprietary stationary phase developed by J&W for the specific analysis of this product proves highly effective in resolving the problem gasoline components, particularly 2-methylpentane and 3-methylpentane from MTBE.

- *Fabulously Fast FAMEs on DB-WAX and DB-225.*

This application offers great resolution of standard FAME components by use of 0.10 mm ID DB-WAX and DB-225 columns from J&W. The use of these capillaries provides excellent resolution with a very short run time of only 12 minutes.

The issue also offers valuable information regarding the use of gas purification traps, an often bewildering subject due to the wide range of traps on the market today and their varied uses. This in-depth article appears in its first part, part two will be published in a later issue of *Separation Times*.

For more information about J&W Scientific, the low bleed leader, or for additional information about this issue of *Separation Times* (Volume 11, Number 3),

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NEW BREED OF ELECTRON MULTIPLIERS FROM SGE OFFER SIGNIFICANT BREAKTHROUGH IN GC-MS AND LC-MS TECHNOLOGY

ETP Active Film Multipliers from SGE are a significant breakthrough in electron multiplier technology. This new breed of electron multiplier is completely air stable, providing very high sensitivity, low noise, and longer operating life.

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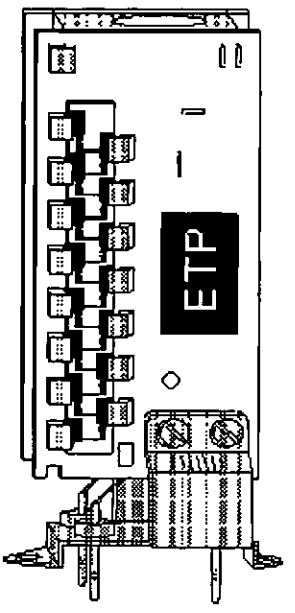

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Electron multipliers enable ion generated from minute amounts of chemical sample to be amplified to sufficient levels for detection and integration by an instrument data system.

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Will SGE Active Film Multipliers suit my instruments?
There is no risk in switching from your current multiplier. Active Film Multipliers are direct "plug-in" replacements for the original multipliers. Some systems require additional connecting leads for first time installations, which are supplied by SGE. Each model has been tailored for total compatibility with each instrument's software to ensure high signal-to-noise ratio.

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HEWLETT PACKARD INTRODUCES NEW HP 5973 MSD SYSTEM FOR HIGHLY SENSITIVE EI, PCI AND NCI ANALYSES

Hewlett Packard (HP) Company have introduced the HP 5973 MSD system for electron ionisation (EI), positive chemical ionisation (PCI) and negative chemical ionisation (NCI) analyses. Designed for chemists detecting and measuring trace-level compounds in complex matrices, the enhanced system offers unsurpassed sensitivity and ease of use. Existing turbopump HP 5973 MSD systems can be retrofitted for PCI and NCI analyses.

Sensitivity
In the EI and PCI full-scan modes, the system provides low-picogram-level sensitivity. In the NCI mode, it provides sensitivities that are up to 1000 times greater (low-femtogram level sensitivity).

Simplicity of Operation
A simple graphical user interface makes it easy for users to switch between the PCI and NCI modes, and automated tuning allows easy set-up of PCI and NCI analyses. Direct access to the ion source simplifies maintenance.

Chemical Ionisation
Chemical ionisation is a gentle technique in that it keeps most of a sample's molecules intact. PCI mode can give positive proof of a molecular ion, and therefore determine a molecular weight, through the use of adduct ions. PCI mode also can determine molecular weights for compounds that may not be identified in EI mode.

Negative Chemical Ionisation
NCI is useful for quantifying targeted, known compounds at

extremely low concentrations. It also provides the selectivity needed to quantitate compounds in such complex sample matrices as foods and biological samples. The NCI mode is primarily applicable to compounds that can capture thermal electrons. However, through derivatisation, many compounds can be made amenable to electron capture, substantially increasing the number of compounds that can be analysed using this highly sensitive technique.

Information about HP chemical analysis products and services can be found on the World Wide Web at http://www.hp.com/go/chem.

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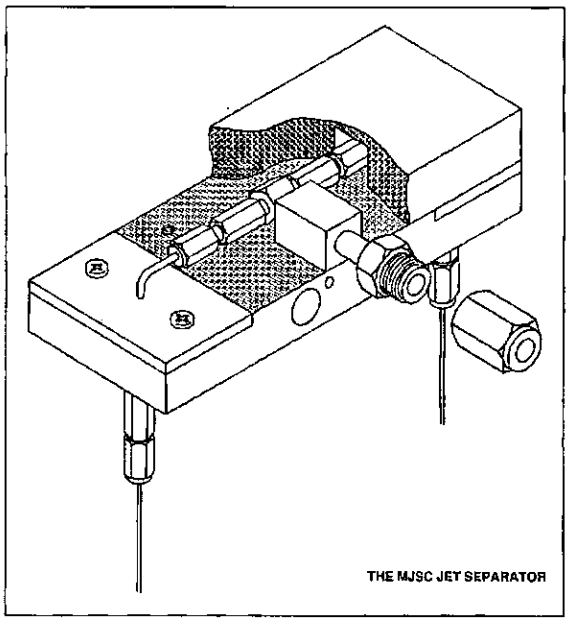
HIGH PERFORMANCE JET SEPARATOR FOR HEWLETT PACKARD MS DETECTORS

For interfacing 0.53 mm ID capillary columns with Hewlett Packard bench-top MS detectors - from SGE.

- High enrichment and yields.
- Suitable for interfacing with HP5970, HP5971 and HP5972 MS detectors.
- Easy to assemble, clean and maintain.
- Inert surface prevents thermal degradation.
- Ideal for use with 0.53 mm ID capillary columns.


THE MJSC JET SEPARATOR

What is the MJSC?
The patented replaceable jet, molecular jet separator, MJSC, permits high performance interfacing of a GC and bench-top MS detector, where the limited detector pumping capacity restricts the use of capillary columns with high carrier gas flowrates. This applies particularly to 0.53 mm ID columns.

How does MJSC work?
The MJSC preferentially removes carrier gas from the capillary column outlet, enriching the sample components entering the MS detector.

How does MJSC improve MS performance?
The results achieved with MJSC are remarkable. Using optimised jet configurations and helium as a carrier gas, the MJSC offers yields of greater than 40% and compared to an open split interface system, shows a 5- to 10-fold increase in enrichment.

How do I install the MJSC?
SGE specifically designed the MJSC for interfacing the Hewlett Packard HP5890 GC with a mass selective detector. It is mounted onto the roof of the HP5890 oven. The heater block assemblies are designed to utilise the existing heater cartridge and temperature sensors fitted to the GC detector and injector housings. The jet separator is supplied assembled with inlet/collector jet sets, suitable for helium carrier gas flowrates of 15 mL/min.

For further details and a data sheet,
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THE NEW ALLTECH GC/MS SWITCHING VALVE

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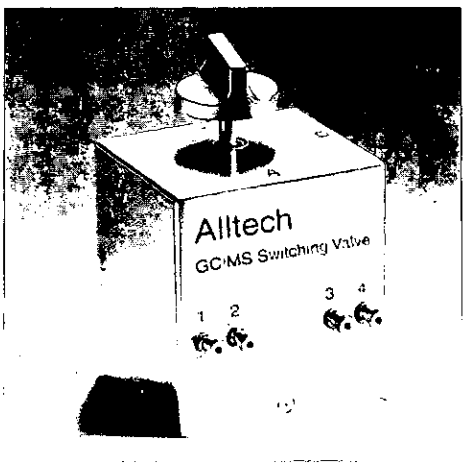
- Switch between two different installed columns without GC/MS shutdown.



The new Alltech GC/MS switching valve eliminates the down-time associated with column switching. Changing a column in a normal GC/MS requires turning off and restarting the vacuum source. This causes lengthy delays as well as the creation of potential air leaks at the new column connections. The GC/MS switching valve overcomes all of these potential problems and delays. Replacement of the primary column occurs while the secondary column provides flow to the MS, and vise versa. The GC/MS operation never needs to be interrupted.

Compare the two chromatograms (Figure 1) one using the GC/MS valve and one without. Notice that there are no adverse affects such as adsorption or a shift in retention times.

Valve installation is easy. Simply attach the valve to the oven wall (if desired) and attach the capillary columns and MS transfer line to their appropriately labelled nuts. The time saved and ease of operation of this valve make it a necessity for any GC/MS with two injection ports.

Column:	AT-5, 30 m x 0.25 mm x 0.25 µm (Part No. 13656)
Temperature:	130 °C
Carrier Gas:	Helium, 25 cm/sec
Detector:	MSD @ 300 °C
Split Ratio:	100/1
Peaks:	1. 1-Octanol
	2. 2,6-Dimethylphenol
	3. 2,6-Dimethylaniline
	4. Naphthalene
	5. n-Tetradecane
	6. Methyl Undecanoate
	7. Methyl Dodecanoate

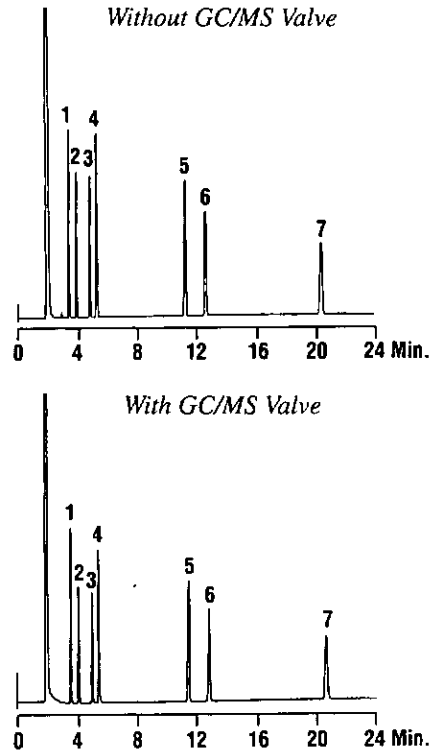


Figure 1. Comparison of retention times and analyte activity.

GC/MS Switching Valve
for 0.32 mm ID Capillary Columns part # 12327
for 0.25 mm ID Capillary Columns part # 12325

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Gas Chromatography, GC-MS Environmental Applications

GC, GC-MS AND SPME
The Total Solution To Environmental Monitoring?

Dr Peter Boniface, Laboratory Services, Watercare, P O Box 59077, Mangere Bridge

New Zealand's "clean green" image is dependent on the use, development and protection of our natural resources. The Resource Management Act is designed to plan the use, development, and protection of those resources. To ensure sustainable management of our resources pollutants such as pesticides, volatiles, and phenols must be monitored. The Resource Management Act allows for prosecutions to be brought against people who violate the act and monitoring of pollutant levels provides part of the evidence that the said violation has occurred.

Gas chromatography (GC) coupled with a detection system is a powerful technique for the separation and analysis of various pollutants which may be present in our environment. There is a wide range of detectors available including flame ionisation detectors (FID), electron capture detectors (ECD), thermionic specific detectors (TSD) and perhaps the ultimate, the mass selective detector (MSD). The FID detects all organic compounds at concentrations ranging from a few parts per billion (ppb) to percentage levels. It has almost no response to inorganic compounds and elemental gases and is the most popular and commonly used detector. At Watercare it is used for the detection of volatile acids and total petroleum hydrocarbons in water and trade waste samples.

The ECD is a very sensitive detector selective to electron absorbing compounds in quantities down to sub picogram levels. These detectors are used for the analyses of a broad range of pesticides and biological compounds after the samples (carboxylic acids and amines) have been derivatised. At Watercare this detector is used for the determination of organochlorine pesticides e.g. dieldrin), acid herbicides (e.g. 2,4-D) and pentachlorophenol in water, trade waste, and soil samples.

The TSD detector detects nitrogen and phosphorus containing organic compounds in trace quantities. Because of its selectivity for nitrogen and phosphorus over carbon it is very useful for analysing compounds containing these elements in complex samples such as pesticides in plants and air pollutants. At Watercare it is used for the analysis of organonitrogen and organophosphorus pesticides in water and trade waste samples.

The MSD detector offers a fingerprint of the compound analysed. The combination of the GC separating ability and the MSD ability to distinguish between two compounds of same retention time due to their different mass spectra offers a very powerful sensitive technique for the analysis of complex mixtures for a wide variety of organic pollutants. At Watercare this detector is used for the analysis of semi-volatiles, phenols, volatiles, and polyaromatic hydrocarbons. The use of GC-MS allows the use of deuterated internal standards at Watercare. These compounds are deuterated analogues of the compound to be analysed and behave exactly the same as the analyte in question. The MSD detector allows the analyte and internal standard to be distinguished by their different mass spectra and gives very accurate reliable quantitative results.

Solid phase microextraction (SPME) is a new technique for sample preparation which, in combination with GC-MS, provides a very powerful means to screen and analyse water and trade waste samples for organic pollutants. SPME involves the absorption of analytes directly from an aqueous sample, or from the headspace above liquid or solid samples, onto a coated, fused silica fibre. The fibre is then desorbed in the injection port of a GC and analysed by GC-MS. The technique replaces time-consuming manual sample preparation techniques that require large amounts of expensive solvents. SPME in combination with GC-MS can also be used for the analysis of some inorganic species for example methyl mercury and mercury(II) in water and solid samples (1). SPME is fast, solvent-free and automated, and is used by Watercare for the analyses of phenols and volatile compound at ppb levels. SPME, in combination with GC-MS, is also used by Watercare to screen water and trade waste samples for pollutants. The SPME process extracts a wide range of organics which can then be desorbed into a GC-MS and identified using the mass selective detector. A few examples of SPME coupled with GC-MS that Watercare has been involved in include:

- A wastewater treatment plant with a toxicant detecting bacterial system on the raw sewage intake had a series of alarms suggesting high toxicant levels. Analysis of these samples by SPME-GC-MS showed much higher than normal levels of nonylphenols suggesting these were the culprit.

- A printing company wanted a rapid screen of their effluent to identify major components for disposal. A SPME-GC-MS screen showed large quantities of trichloroethane and smaller amounts of toluene and xylenes.

- A company which handles the disposal of trade waste wanted to know the components of a drum of waste submitted by a chemical company in order to determine a suitable treatment process. Analysis by SPME-GC-MS showed the presence of dichloromethane, chloroform, trichloroethane and dichlorobenzenes.

- A regional authority found dead fish and other sea life around a stormwater outfall. Screening of a sample by SPME-GC-MS showed large amounts of toluene, xylenes and dichlorobenzenes which gave indicators as to "who did this?"

• A wastewater treatment plant used SPME-GC-MS to provide a "fingerprint" of the raw sewage coming into the plant and to see what organics were present in it. It was also used to compare the initial sewage fingerprint to that of the final effluent to see how well the treatment process was working.

GC and GC-MS are clearly powerful tools for analytical and environmental chemists for screening samples for pollutants in our environment. In combination with SPME, an invaluable new technique for solvent-free rapid screening of water and trade waste samples, the power of GC and GC-MS is further enhanced, offering a total solution to the identification and analysis of environmental pollutant monitoring.

References

1. Cai,Y and Bayona, J M (1995) *J. Chromatog. A* **696**:113.

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Chlorophenols In Drinking Water Using GC/MS/MS

I Turnes, I Rodríguez, C M García, R Cela
Departamento de Química Analítica, Universidad de Santiago de Compostela, Spain

Introduction

There is currently great environmental interest in chlorinated phenol derivatives due to their high toxicity and wide industrial use. In response, the United States Environmental Protection Agency (USEPA) has compiled a list of eleven phenols that are considered to be priority pollutants. In 1982, the EEC issued its own pollutant list which includes a large number of polychlorophenols, and established a maximum allowable overall concentration of 0.5 µg/L for these compounds in drinking water.

Few currently available analytical techniques allow the direct determination of chlorophenols at such low concentration levels. This has promoted the development of various procedures for their extraction from their matrices using liquid-liquid extraction, solid phase extraction or carbon cartridges. In every case, large volumes of sample have to be processed and then the final extracts must be concentrated. This solvent evaporation step has been shown to result in major losses of several chlorophenols[1].

Chlorophenols are usually determined by use of chromatographic techniques such as HPLC or GC. However, because of their high polarity, they give broad tailed peaks if separated directly (without prior derivatisation) by GC. The effect worsens as the chromatographic column ages. It is therefore advisable to convert chlorophenols into less polar forms in order to improve peak shape, resolution and sensitivity[2]. Acetylation is the most frequently used reaction for this purpose.

It is preferable to use a highly selective and sensitive detection technique such as tandem mass spectrometry for this analysis. In fact, this technique is particularly useful for the analysis of very complex mixtures, as it allows the separation and identification of components with different structures that are eluted at similar retention times and with widely different concentration levels. Also, increased signal-to-noise ratios afford the sensitivity needed for low trace level analysis without having to process large volumes of sample. The purpose of this work was to develop a method for the routine determination of chlorophenols at the parts-per-trillion and lower levels in drinking water by use of the Varian GC-ion trap tandem MS.

Results and Discussion

Figure 1 shows the total ion chromatogram for the chlorophenols studied at a concentration of 100 µg/L, acquired over a mass range of 50-300 amu. The base peaks of these spectra were used as the parent ions for the MS/MS analysis. These parent ions are: monochlorophenols (128), dichlorophenols (162), trichlorophenols (198), tetrachlorophenols (232), pentachlorophenol (266), and 4-chloro-3-cresol (142). Dissociation conditions were optimised to achieve a balance between selectivity and sensitivity. To do this, parent ions were dissociated with the aim of obtaining one to three specific product ions of high relative intensity that afforded accurate quantitation and also different relative intensities of product ions for the different isomers. These different ion ratios for different isomers were used to ensure unequivocal identification of each compound. Both aims can be achieved by the appropriate selection of the non-resonant excitation amplitude and RF storage level.

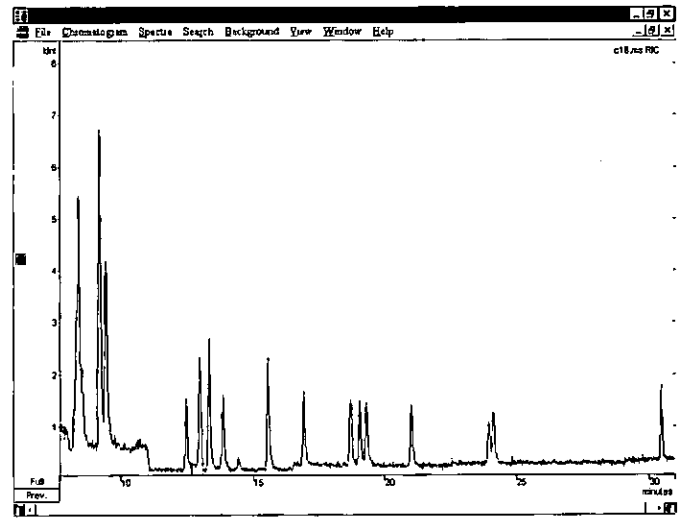

Figure 1. GC/MS/MS total ion chromatogram of 100 µg/L chlorophenol test mix.

Table 1 summarises the results of this optimisation process. A custom library was created by injecting the acetylated standards at a concentration level of 15 µg/L. This library was then used to identify the compounds in the samples. Even when analysing very dilute samples (0.25 pg injected) the degree of fitting and purity obtained was quite satisfactory (70-90% purity in the worse case).

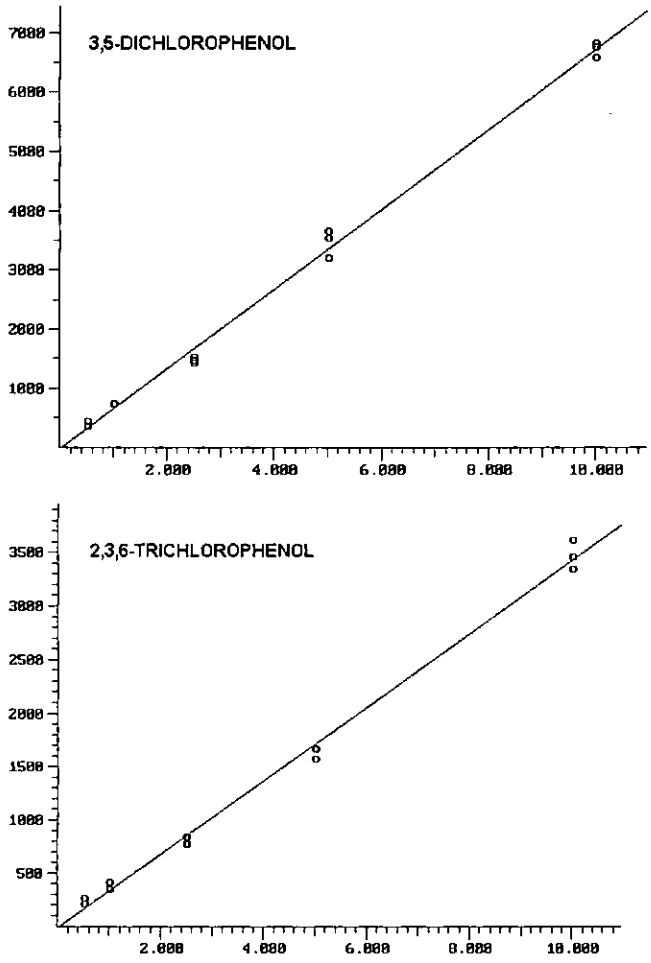

Figure 2. Typical external standard calibration curves for chlorophenols using GC/MS/MS.

Table 1. Results of the optimisation process.

Compound	Excitation Amplitude	RF Level	Product Ion
2-CP	68	60	65+100
3-CP	68	60	65+100
4-CP	68	60	65+100
2,6-DCP	81	75	99+126
2,5-DCP	81	75	99+126
2,4-DCP	81	75	99+126
3,5-DCP	81	75	99+126
2,3-DCP	81	75	99+126
3,4-DCP	81	75	99+126
2,4,6-TCP	74	70	97+135
2,3,6-TCP	74	70	97+135
2,3,5-TCP	74	70	97+135
2,4,5-TCP	74	70	97+135
2,3,4-TCP	74	70	97+135
2,3,5,6-TCP	82	80	131+133
2,3,4,6-TCP	82	80	131+133
PCP	92	90	167
4-Cl-3-Cresol	60	55	77

The limit of quantitation was calculated at a S/N ratio of 6 and these results are shown in Table 2. These limits are well below the legally established limits (0.5 µg/L) in drinking water. This method affords detection levels between 24-60 ng/L for a 10 mL sample and 40-95 pg/L for a 1 litre sample.

Table 2. Results of the limit of quantitation.

Compound	Limit of Quantitation (µg/L) (S/N=6)	Repeatability RSD (%) (n=10)
2-CP	0.14	8.0
3-CP	0.12	5.5
4-CP	0.08	14.7
2,6-DCP	0.08	9.1
2,4+2,5-DCP	0.09	8.4
3,5-DCP	0.08	3.1
2,3-DCP	0.08	15.7
3,4-DCP	0.08	9.3
2,4,6-DCP	0.11	6.5
2,3,6-TCP	0.08	11.9
2,3,5-TCP	0.08	7.7
2,4,5-TCP	0.08	15.7
2,3,4-TCP	0.16	13.8
2,3,5,6-TCP	0.19	13.9
2,3,4,6-TCP	0.13	13.0
PCP	0.10	15.6
4-Cl-3-Cresol	0.11	7.6

Conclusion

Based on the results obtained in this work, GC/MS/MS allows the quantitation of chlorophenols in the pg/L range in drinking water by solid phase extraction from sample volumes of 1-5 litres. In the routine quality control analysis of drinking water, very low sample volumes (10 mL) have to be processed by derivatisation and subsequent straight-forward extraction. In addition, the proposed method allows one to positively confirm the nature of each species and to distinguish between polychlorophenol isomers, a clear advantage over other techniques customarily used for the analysis of phenols. The low cost of benchtop instruments for implementation of the proposed method makes it a serious choice for the routine determination of chlorophenols in drinking water and other types of samples of environmental interest.

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Climate Change - A New Zealand Coal Industry View

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Abstract

Coal remains an important energy resource for New Zealand. It is widely available throughout the country, it is used by a number of New Zealand's key industries, and there are reserves sufficient to last many centuries at present rates of use.

Concerns about climate change and carbon dioxide (CO_2) are such that the coal industry cannot dismiss them. The coal industry must develop a pro-active and forward looking strategy to face the challenges of potential climate change.

This paper considers the issue of climate change, the current scientific consensus of what climate change could occur, and the uncertainties that surround this consensus. It summarises the present government policy on climate change, and analyses New Zealand's current CO_2 and other greenhouse gas emissions. The analysis demonstrates that increases in New Zealand's CO_2 emissions since 1990 are mainly associated with the transport and the petrochemicals sectors. The coal industry and its customers are demonstrated to be managing their CO_2 emissions.

Positive initiatives to deal with greenhouse gas emissions are discussed, including industry voluntary agreements, clean coal power generation technologies, and carbon sequestration. Voluntary agreements are on target to save 1.5 million tonnes of CO_2 emissions per year by 2000. Clean coal power technologies are being developed which will ensure coal remains an option for power generation in the future. Carbon sequestration by capturing CO_2 emissions and disposing of them in a stable form is now being demonstrated to be technically feasible. Carbon sequestration by forests also presents a real option for managing atmospheric CO_2, particularly in New Zealand.

This paper re-examines the objectives of climate change policy. Climate change policy must lead to genuine reductions in greenhouse gases in the atmosphere, and not damage the economy. A policy based on sector specific targets is recommended.

Introduction

Climate change is an issue that the coal industry cannot ignore. It dismisses concerns about CO_2 emissions at its peril. Current no-action scenarios see global CO_2 emissions increasing by between three and five times in the next century. The coal industry and other energy industries worldwide must recognise and address this issue.

Coal represents 74% of New Zealand's energy resources. It has contributed significantly to New Zealand's economic growth and given the size of the resource, it will be of considerable importance in the future. Considering the future energy gap (when gas resources are largely depleted), coal offers an opportunity to maintain economic growth.

8.6 billion tonnes of coal have been identified as the technically recoverable resource. This is equivalent to 118,000 petajoules (PJ) which is comprised of: 8% bituminous coal, 22% sub-bituminous coal, and 70% lignite. This represents over 90% of New Zealand's estimated fossil fuel resources and is equivalent to more than thirty times the remaining Maui gas reserves.

Cave and Saha[1] found that even with conservative assumptions, this recoverable coal resource comprises 74% of New Zealand's total energy resources (using established criteria for assessing hydro, wind, and biomass resources).

They concluded that coal will again become an important component in electricity generation in New Zealand. The first impact of this would be when Huntly Power Station switches to coal between 1999 and 2007. By 2015 enough coal would need to be available to supply at least one and possibly two further coal-fired power stations. Significant research and development is being undertaken worldwide on clean coal technologies, such as Integrated Gasification Combined Cycle. It is anticipated such technologies will reduce CO_2 emissions from coal-fired generation by 20-30% compared with Huntly Power Station.

Coal is the principal source of energy for cement production and for the iron and steel industry (where there is no alternative to carbon as a chemical reductant). There are also many smaller industries which rely on coal, particularly in the South Island where there is no pipeline gas alternative and coal is by far the most economical fuel. Low cost energy produced by an efficient private sector coal industry is central to the competitiveness of many of these industries. Coal is used by most of New Zealand's major export earners, including the dairy, meat, wool, and forestry industries. Over half of New Zealand's export income comes from the meat, dairy, forestry, iron, and aluminium sectors and together these exports account for about 55% of energy used in industry.

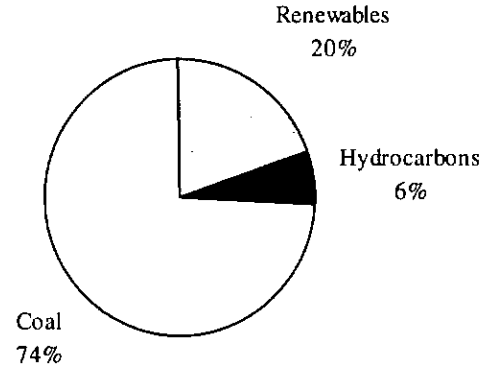

Figure 1. *Relative Size of New Zealand Energy Resources.*

The mining industry in New Zealand produces coal, gold and silver, building and roading aggregate, industrial minerals and iron sand with a total value of close to $1,000 million per year, and directly employs more than 4,000 people on a full-time equivalent basis. Several times this number are employed indirectly in industries supplying services to mining, and in jobs resulting from increased economic activity generated by mining industry spending. Coal mining comprises about 25% of the mining industry in New Zealand. While coal mining is a significant industry in New Zealand, this country's coal output amounts to only 0.1% of all the coal mined throughout the world. Studies in the United States in 1995 indicated that eleven jobs were created elsewhere for every coal miner employed. If this ratio is applied to the 880 New Zealand coal mining jobs, the indirect employment level is of the order of 10,000 jobs.

Key Facts about Coal Mining in New Zealand

- Value of coal output - more than $200 million per year.
- Proportion of total New Zealand mine and quarry output - more than 25% by value.
- Tonnage produced - 3.45 million tonnes in 1995.
- Number directly employed - 880.
- Number of active mining operations - 15 Waikato, 29 West Coast, 11 elsewhere in South Island.
- Main users (1995) - 40% exported, 20% used for steel making in New Zealand.
- Estimated total resources - 8,600 million tonnes.
- Proportion of known fossil fuel resources - 90%.

Climate Change Science

The Intergovernmental Panel on Climate Change (IPCC) in their latest report *Climate Change 1995 - The Science of Climate Change*[2] present a detailed review of available scientific evidence on climate change. While the conclusions of this report may not be accepted by everyone they do represent the accepted view on climate change and should be acknowledged by the coal industry.

In summary the report concludes that the balance of evidence suggests there has been a discernible human influence on climate. It sets a number of scenarios and climate changes by 2100. These would be equivalent to increases in sea level of 15 to 95 cm by 2100.

It is important to note that:

- The models are not proved and in particular they have not been able to simulate climate over the last 100 years.
- There is an inadequate understanding of the importance of water vapour and clouds.
- Direct and indirect cooling effects of fossil fuel sulfate aerosols will impact on global temperatures.
- Future greenhouse gas emissions will depend on population and GDP growth.
- Estimates of economic losses from greenhouse gas reduction vary widely.
- Costs of adaptation to climate change and the impacts of climate change are not understood.

The report is best summed up as a recommendation to select a prudent greenhouse gas emission reduction strategy and adjust it in the light of new information.

Government Climate Change Policy

The Government's current climate change policy was developed in 1994 and in effect aims to achieve about 20% reduction in net CO_2 emissions (below business as usual projections) by 2000. Four fifths of this reduction was planned to come from increased absorption by forests. Government estimated that new plantings of 100,000 hectares of forest per year would be more than sufficient to absorb all extra emissions. Government also aimed to achieve one fifth of the reduction by a range of policy measures such as:

- Voluntary agreements,
- Energy sector reform,
- Energy efficiency strategy,
- Transport policy,
- RMA call-ins for major projects.

Government left open the option of a carbon tax this year if it was not on target to achieve its aimed reductions. A carbon tax has not been introduced, one reason being the success of voluntary agreements with industry. However the Government is certain to review its position following the Kyoto conference, depending on the commitments made at that conference.

New Zealand Greenhouse Gas Emissions

Figure 2 shows that New Zealand's CO_2 emissions in 1996 had increased by 2.8 million tonnes per year since 1990 (11.2%). The increases were not uniform across each sector. The information has been extracted from Ministry of Commerce figures[3].

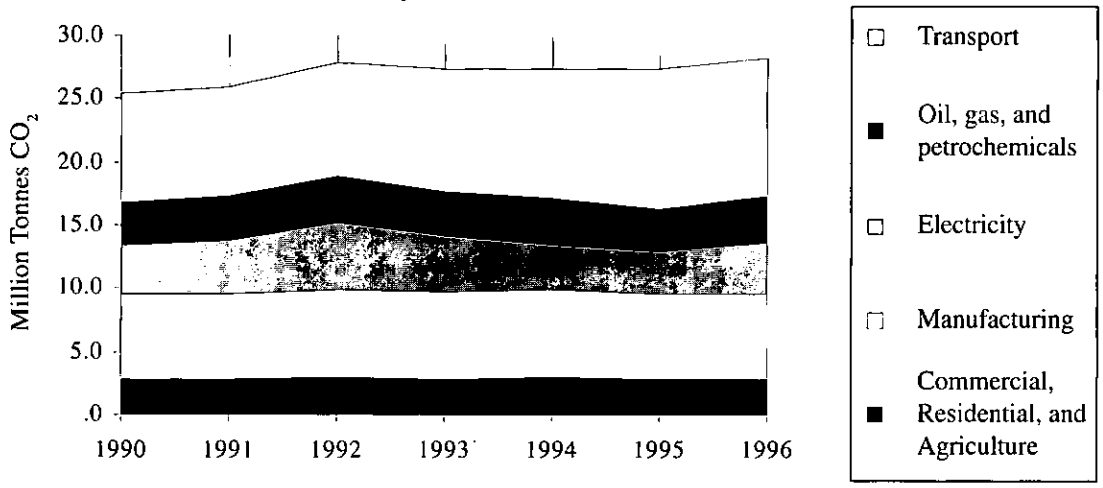

Figure 2. *New Zealand CO_2 Emission Trends by Sector.*

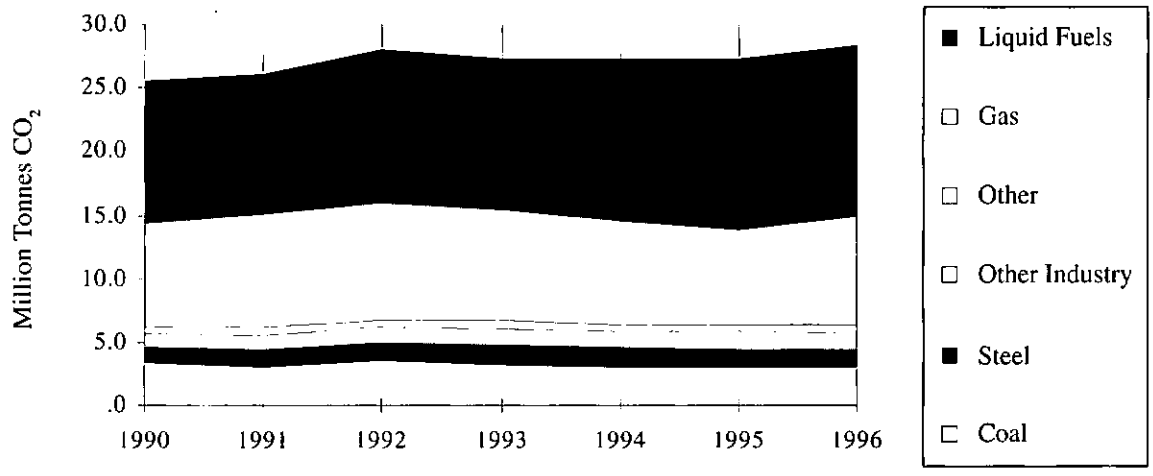

Figure 3. *New Zealand CO_2 Emission Trends by Fuel.*

Nearly all the increase came from transport, 2.4 million tonnes (a 27% rise) and oil and gas processing including refining and petrochemical production, 0.3 million tonnes (9%). Emissions from the other sectors which include the coal industry's clients had hardly changed, except that emissions from electricity generation go up and down on a year to year basis, largely controlled by variability of hydro-electricity availability.

Figure 3 shows that CO_2 emissions from the use of coal have in fact decreased since 1990. Liquid fuels account for most of the increased emissions with emissions from gas varying from year to year. This variation is largely related to the demand for gas-fired electricity.

These trends clearly demonstrate that if New Zealand is to manage its CO_2 emissions it must focus on transport sector emissions. It cannot expect other sectors of the economy to reduce emissions enough to compensate for transport sector emission rises.

In addition it is particularly important for New Zealand to take a comprehensive approach on all greenhouse gases rather than focusing on CO_2.

Figure 4 highlights New Zealand's human sourced contribution of greenhouse gases for 1995 both in terms of tonnes emitted and more importantly in relative impact on the greenhouse effect (tonnes of CO_2 equivalent calculated from 100 year Global Warming Potentials). Figure 4 shows that CO_2 forms only 17% of New Zealand's greenhouse gas emissions and that half of these CO_2 emissions are reabsorbed by new forest plantings.

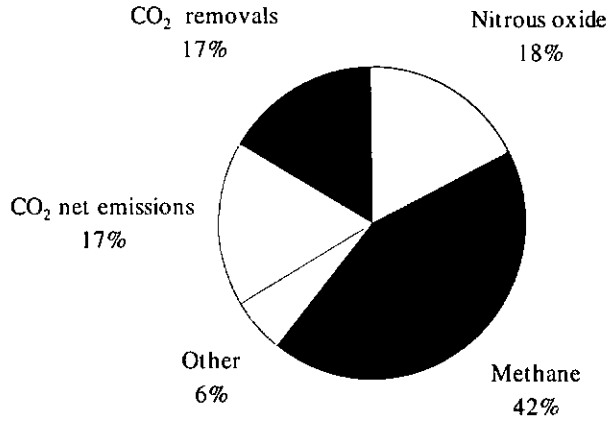

Figure 4. *New Zealand Greenhouse Gas Emissions 1995.*

In assessing the impacts of any economic instrument on the economy as a whole it will not be sufficient to select a policy such as carbon tax which will primarily impact on industry. Industry contributed only 7% of New Zealand's net greenhouse gas emissions in 1995 (in terms of equivalent CO_2). If New Zealand is serious about reducing greenhouse gases targeted policies are required for all greenhouse gases in all sectors.

Voluntary Agreements

Voluntary agreements to reduce CO_2 emissions represent a co-operative initiative by industry and government. The coal industry sector has welcomed the voluntary approach as a pro-active initiative to demonstrate its concern about the climate change issue.

Twenty voluntary agreements have been signed between industry and government, including a single industry agreement by the three cement companies. The voluntary agreements covered organisations emitting 11 million tonnes of CO_2 in 1990. This represented 43% of New Zealand's emissions or 65% of New Zealand's non-transport emissions. Eventually it is likely that about three quarters of New Zealand's non-transport CO_2 emissions will be covered by voluntary agreements. The coal industry and its customers have been at the forefront of voluntary agreement initiatives. Eleven of the twenty agreements include coal users and two are coal producers and cover some 70% of coal used in New Zealand and 85% of coal produced.

Voluntary agreements have been assessed by EECA[5] to be on track by 2000 to save 1.5 million tonnes of CO_2 compared with the projected emissions for 19 industrial groups and companies. Further gains may be made from electricity generation but can not be assessed on the same basis. This is a comparison with "hypothetical" or frozen efficiency base year equivalents because it is difficult to relate this to the Business as Usual model. One of the reasons for this is that some industries undergoing major expansion were unlikely to do so at their initial level of efficiency.

One fifth of the 22-25% CO_2 growth projection for the whole economy from 1990 to 2000 is 1.2 million tonnes which might suggest up to double the required emission savings will be achieved from the voluntary agreement scheme alone.

A successful industry/government agreement for emission reduction from a sector or organisation requires:

- agreement on assessment methods and maintenance of information records,
- acceptance that different sectors and organisations have different potential because of past savings and current capital availability,
- acceptance that different arrangements (formal and informal) may be required in different situations.

Voluntary measures have the advantage over economic instruments of encouraging widespread ownership of the problem of reducing CO_2 emissions. Another advantage is the development of a co-operative approach rather than coercion. Different solutions can then be tailored for specific situations and this helps the spread of emission reduction over all parts of the economy. By assessing the potential for emission reduction in an industrial sector and the individual potential for different plants, recognition can be given for past savings and the most cost effective opportunities identified. Users can demonstrate that they are using the best practicable option technology and that their emissions per unit production are decreasing even if their total emissions are not.

Voluntary measures are based on a thorough analysis of the potential in each sector and are consequently a more cost effective solution than a blunt carbon tax. It would be uncertain how much emission reduction could be achieved by a carbon tax, because part of the emission reduction comes from the economic damage caused by reducing activity in the energy intensive market sectors. A co-operative atmosphere would be difficult to develop after a carbon tax had been applied.

Voluntary agreements have costs associated with the monitoring and extra energy efficiency initiatives, since investment decisions may be brought forward which are not justified on a commercial basis alone. Nevertheless, voluntary measures are considered to be a low cost alternative to the damage caused by a carbon tax. These measures are particularly advantageous for the coal industry since a carbon tax is a blunt economic instrument which has an inequitable effect on coal, the most economical fuel.

Carbon Tax Impacts on Coal Users

Carbon taxes are claimed to be a way of promoting CO_2 emission reductions in the most cost efficient way. While this may be the case with a global tax in an ideal world, if a carbon tax was applied in New Zealand, savings in CO_2 emissions would occur primarily by closing down major industries and exporting emissions to countries which had not adopted a carbon tax. Additional CO_2 emission savings would result indirectly from the reduced economic activity associated with the loss of these industries.

The most significant impact of a carbon tax would be on the energy intensive industries in the steel, cement, dairy and forest products sectors. Each of these industries exports much (and in some cases the majority) of its production, so there is no opportunity to pass on costs to offshore customers to remain competitive. Similarly, goods produced for the New Zealand market will be less competitive against imported substitutes from countries with no carbon tax. Since energy costs are such a high proportion of these companies' operating costs, they usually have extensive energy efficiency programmes in place, meaning that low cost efficiency gains have already been achieved.

In case studies[6] on the effects of carbon taxes on medium scale coal users, most showed there would be no effect on emissions, but the tax would result in an unrecoverable cost. A tax has the greatest effect on coal because it is the lowest cost per unit of fossil fuel energy and its carbon content is higher than for other fuels. The effectiveness of the tax in reducing CO_2 emissions depends on individual circumstances: whether it could trigger efficiency measures and whether alternative energy sources might become cheaper. The costs of a carbon tax would be borne by farmers in the case of a meat processor, by shareholders in the case of a timber processor, by consumers in the case of a manufacturer, and for hospitals (or schools/universities) would result in extra government spending or further cost cutting exercises.

Carbon Sequestration

In the short to medium term, forest planting provides New Zealand with "breathing space" in the transition to more efficient fossil fuel technologies and increased reliance on renewable forms of energy. At current record pine forest planting rates on new land (60-100,000 hectares per year), CO_2 absorption is likely to more than compensate for the projected 22-25% growth in CO_2 emissions by 2000. The Government's CO_2 policy is unique internationally because of the opportunity for perhaps all of the country's gross CO_2 emissions to be absorbed by newly planted forests. A plantation forest acts as a carbon sink provided a commitment is made to replant after harvest. New Zealand has sufficient land to maintain these planting rates for the next 50 years[7].

Another option is CO_2 separation and disposal from flue or fuel gas streams in power stations, petrochemical plants or other large point sources of CO_2. CRANZ has formed a New Zealand consortium to participate in an international programme, the *IEA Greenhouse Gas R & D Programme* which has the aim of investigating options for reducing the emissions from fossil fuels, and in particular CO_2 emissions from power generation.

The CO_2 can be separated from the flue gas by a variety of methods including chemical or physical absorption, cryogenics or using membrane technology. With gaseous fuels an option is to remove CO_2 from the fuel rather than the flue gas. This is in fact already done when natural gas is contaminated with CO_2 (such as with the Kapuni field). With integrated coal gasification combined cycle (IGCC) it is possible to use oxygen for the gasification reaction rather than air, and to apply a shift reaction so that a resulting gas is a mixture of hydrogen and CO_2. Because of their disparate physical properties these two gases are relatively easily separated by cryogenics or membrane technology. Table 1 summarises work undertaken on behalf of the IEA Greenhouse Gas R & D Programme[8] assessing the costs of CO_2 removal for a number of power generation options: pulverised fuel + flue gas desulfurisation (PF+FGD), natural gas combined cycle (NGCC), and IGCC.

The IEA Greenhouse Gas R & D Programme[9] has also assessed the options for and the cost of long term disposal of CO_2. The options include ocean disposal and storage in geological

Table 1. Carbon Dioxide Capture from Power Stations.

Capture		CO_2 captured	CO_2 avoided (US$/tC)	Power cost (USc/kWh)	Reference
Absorption	PF+FGD	90%	$128	7.4c	4.9ct
	NGCC	85%	$202	5.3c	3.5ct
	IGCC	90%	$319	11.2c	5.3ct
Adsorption	PF+FGD	95%	$308	11.4c	4.9ct
Cryogenics	IGCC	85%	$84	7.8c	5.3ct
Membrane + Absorption	IGCC	80%	$154	8.4c	5.3ct

structures such as depleted oil and gas wells, or aquifers. The results are summarised in Table 2.

From the results it is clear that CO_2 separation, disposal, and storage are expensive but not prohibitive. The major component of the cost is CO_2 separation. It is also evident that sufficient sinks are available for storing large amounts of CO_2 and would have significant impact on global net emissions.

Already CO_2 disposal projects are being undertaken where it is necessary or economic to separate the CO_2 from gas streams for other reasons. A Statoil project off the coast of Norway is stripping CO_2 out of a natural gas stream to get pipeline quality gas, and re-injecting the CO_2 into an aquifer directly above the gas field[10]. The Great Plains Synfuels plant in North Dakota, which produces synthetic natural gas and petrochemicals from lignite, is stripping CO_2 from its fuel gas stream using methanol at low temperatures. It is proposed[11] to use the CO_2 for an oil recovery project in Canada. This project will dispose of the CO_2 as an environmental benefit.

Climate Change Policy

New Zealand should clearly define the objectives of any climate policy it develops or any international commitment it makes. The objectives should:

- cover global greenhouse gas emissions not just New Zealand's emissions,
- include all greenhouse gases not just carbon dioxide,
- recognise the role of carbon sequestration,
- have an appropriate timescale not just focus on the next few years,
- recognise that economic and technology growth will be necessary both to minimise climate change and to mitigate any impacts.

New Zealand's major energy users are predominantly export industries based on adding value to mineral resources and primary produce. With a small manufacturing base and high transport costs to world markets, New Zealand companies maintain their competitive advantage by relying on energy intensive processing to high quality and specialised products. To achieve this, they require coal and other energy sources at internationally competitive prices.

The purpose of the Framework Convention on Climate Change is to reduce global emissions of greenhouse gases and New Zealand has made a commitment to play its part in international action. If New Zealand imposes a low level carbon charge before its trading partners, it will create uncertainty. The usual reason given for introducing such a charge is that it sends a useful signal to investors in energy technology. The danger is that investors may assume that this is a warning of further more severe unilateral action in the future and shift their investment offshore.

Table 2. Carbon Dioxide Disposal from Power Stations.

Disposal Options	Disposal Costs (US$/tC)	Power Cost (USc/kWh)	Reservoir size (Gt C)	Comments
Ocean	$4.1	0.12c	1400 - 2 x 10^7	Significant environmental and legal issues
Aquifers	$4.7	0.13c	87 - 2700	Norwegian project
Depleted Gas Wells	$8.2	0.16c	140 - 310	-
Depleted Oil Wells	-	-	40 - 190	Benefits for enhanced oil recovery
Forests	$5 - $50	-	-	Includes capture

Note global annual CO_2 emissions ~7 Gt C

This is euphemistically described as 'carbon leakage', but could better be termed 'carbon haemorrhage' - a potentially catastrophic effect on those regions whose economies are heavily dependent on the production and use of coal. It would have a negative effect on global emissions, because of the inefficient technologies used in some countries and the transport emissions from importing goods no longer produced in this country.

Voluntary Agreement Scheme
Voluntary agreements have an important role to play in reducing CO_2 and other greenhouse gases from the industrial sector, no matter what size of emission reduction is required. Means must be found to ensure that efforts to control industrial emissions do not force large operators offshore and cripple South Island operators who do not have fuel switching options.

One approach that should be explored is to set a target for industrial emissions and introduce a tax only if voluntary agreements could not deliver. Extensive research is required to identify the potential savings available in each industrial sector. There are strong arguments for adopting such targeted initiatives which tackle each sector differently in recognition of the different issues in each area. Industry/government partnerships would be enhanced if industry sectors were given emissions targets and offered the opportunity to meet them by voluntary means. A co-operative attitude between industry and Government needs to be encouraged rather than having a disincentive imposed unilaterally. There will be greater medium to long term commitment to greenhouse gas emission reduction if the Government develops a range of initiatives which target the different sectors equitably.

Electricity Supply
The logic of the deregulated market seems likely to lead to the construction of more gas-fired capacity in the North Island. This is only a short term solution to greenhouse gas emission reduction because it will result in faster depletion of the gas resource. A medium term view would consider the importance of preserving this resource for more efficient utilisation. The Government must accept the CO_2 implications of the trend to increased generation capacity will mean an increase in gross emissions. Given the large gap between the gas price and other generation alternatives, a carbon tax is likely to do little to reverse this trend.

Other Greenhouse Gases
A comprehensive approach must be taken on all greenhouse gases rather than focusing on CO_2. A least cost solution is not possible if the focus is on one gas alone. Other greenhouse gases, particularly methane, are generated from a wide variety of disparate sources including ruminant animals, many land use practices, oil, gas and coal production, combustion (of biomass as well as fossil fuels), and industrial processes. Targeted policies are required for all greenhouse gases in all sectors.

In assessing the impacts of any economic instrument on the economy as a whole, it must be remembered that industry contributed only 7% of New Zealand's net greenhouse gas emissions in 1995 (in terms of equivalent CO_2 using 100 year Global Warming Potentials).

Carbon Storage
Targeted policies should be developed for all forms of CO_2 absorption including afforestation, management of indigenous forests, soil conservation, and management of biomass within the 320 km limit of the Exclusive Economic Zone (perhaps including nutrient fertilisation of phytoplankton growth which is currently under research). Research and development into CO_2 separation and disposal options should be promoted to improve the economics and investigate environmental and other implications.

Transport
The transport sector accounts for 40% of CO_2 emissions. The growth rate is highlighted by the Ministry of Commerce statistics[3], showing a 27% increase (1990 to 1996) in domestic transport sector emissions.

Despite such growth in emissions and the high proportion of total emissions it is recognised that any economic instrument will have a minimal effect in this sector. There is therefore a compelling case for a mixture of regulations, investment and financial incentives. It is not acceptable that other sectors are squeezed. A range of possibilities are available including a transport specific tax, speed limits, changes in fleet size, and alcohol blending.

Conclusions

1. The coal industry must develop a pro-active strategy to manage its greenhouse gas emissions if it is to continue to remain competitive in a world that is increasingly concerned about global climate change.

2. Scientific developments are leading to a better understanding of the climate change problem, but a large number of uncertainties remain.

3. New Zealand's coal industry and its customers are managing their CO_2 emissions with increases for manufacturing industries between 1990 to 1996 being limited to 2%. On the other hand in the same period there has been a 27% increase in transport sector emissions and a 9% increase from oil, gas, and petrochemical production.

4. Voluntary agreements have been assessed by EECA to be on track to save by 2000 1.5 million tonnes of CO_2 annually compared with the projected emissions for 19 industrial groups and companies.

5. Carbon sequestration, either by capture and disposal or by biological means, has the potential to allow humanity to manage atmospheric CO_2 levels.

6. A "no regrets" policy is the appropriate risk management strategy while there is still so much scientific uncertainty. However there will be pressure for increased reduction targets.

7. The Government's greenhouse gases policy should be to seek reductions in global greenhouse gas emissions while preserving New Zealand's international competitiveness.

8. The proposed low level carbon charge will meet neither of these objectives and is not recommended as a policy option because it is flawed in its objective and its desire for simplicity.

9. A policy that meets the objectives will:
   - consider net emissions,

- include all greenhouse gases,
- cover all sectors of the economy,
- be based on sound data, including cost benefit analysis,
- need wide public and industry acceptance.

10. Sector targeting is the viable alternative to relying on market theory. It will share the burden and achieve genuine rather than illusory gains. The continuation of the voluntary agreement scheme would be an important component of this.

11. Carbon absorption projects such as afforestation are an important part of the least cost solution for New Zealand.

Acknowledgements

The above paper was presented at the 7th New Zealand Coal Conference 15-17 October 1997 in Wellington and includes a lot of the information covered in the 1997 NZIC Presidential Address.

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CONFERENCES & SEMINARS

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26 June - 2 July 1998

9th Congress of the International Society for Biomedical Research on Alcoholism (ISBRA)

Venue: Copenhagen, Denmark

Contact: Professor Christer Alling
Department of Medical Neurochemistry
Institute of Laboratory Medicine
University Hospital
S-221 85 Lund, Sweden
Fax: (+46-46)-175376

12-17 July 1998

MACRO98

37th IUPAC International Symposium on Macromolecules

Venue: Conrad Jupiters Hotel
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) E Rizzardo (Australia), 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

CONFERENCES & SEMINARS

Email: macro98@chemistry.uq.edu.au
Web Site: http://www.uq.edu.au/~cmawhitt/macro98.html

23-26 July 1998
18th International Machinery and Materials Exhibition for Asia - Mex 98
Venue: Hong Kong International Trade and Exhibition Centre, Hong Kong
Contact: Business and Industrial Trade Fairs Limited
Unit 1223, 12/F
Hong Kong International Trade and Exhibition Centre
1 Trademart Drive, Kowloon Bay, Hong Kong
Tel: (+852)-28652633
Fax: (+852)-28661770 or (+852)-28662076

2-7 August 1998
The 9th International Symposium on Novel Aromatic Compounds (ISNA-9)
Venue: The Hong Kong Convention and Exhibition Centre, Hong Kong
Contact: Professor B Halton
Chemistry Department
Victoria University
P O Box 600, Wellington, New Zealand
Fax: (+64-4)-4955241
Email: brian.halton@vuw.ac.nz

24-28 August 1998
17th International Cancer Congress
Venue: Rio de Janeiro, Brazil
Contact: Congrex do Brazil
Ruad do Ouvidor, 60 gr 413
20040-030 Rio de Janeiro RG, Brazil
Fax: (+55-21)-2231492

30 August - 4 September 1998
7th European Symposium on Thermal Analysis and Calorimetry
Venue: Balatonfüred, Hungary
Contact: Professor György Liptay
Hungarian Chemical Society
Tel/Fax: (+36-1)-2018056
Email: estac7@ch.bme.hu

23-25 September 1998
International Symposium on Preparative and Industrial Chromatography and Allied Techniques - SPICA 98
The subject of SPICA 98 will focus on isolation, purification and fractionation of value-added products, e.g. fine chemicals, natural products, pharmaceuticals, biotechnical products, agrochemicals, aroma and food additives, applying chromatographic techniques, membrane technology and electrophoresis. In conjunction with the Symposium, an exhibition of instruments will be held, giving participants the opportunity to meet most of the world's leading suppliers of preparative and industrial separation products and technologies.
Venue: Strasbourg, France
Contact: Secretariat SPICA 98
ENSIC
1, rue Grandville - B.P. 451
F-54001 Nancy Cedex, France
Tel: (+33-383)-175003
Fax: (+33-383)-350811
Email: brionne@ensic.u-nancy.fr

17-20 September 1998
Polyurethanes Expo 98
Venue: Wyndham Anatole Hotel, Dallas, Texas, USA
Contact: Polyurethane Division
Tel: (+1-212)-3515425
Fax: (+1-202)-2966877

13-16 October 1998
Preparative High Performance Liquid Chromatography Training Course
Venue: Champigneulles, France
Contact: PROCHROM S.A.
Training Courses
BP. 9
F-54250 Champigneulles, France
Tel: (+33-0)-383312244
Fax: (+33-0)-383312051
Email: prochrom@millipore.com

18-22 October 1998
14th International Clean Air and Environment Conference
Venue: Melbourne Hilton on the Park, Melbourne Australia
Contact: PR Conference Consultants Pty Ltd
Tel: (+61-3)-98169111
Fax: (+61-3)-98169287
Email: prcc@labyrinth.net.au
Website: http://www.labyrinth.net.au/~prcc

7-9 December 1998
First Singapore Chemical Conference
Venue: Singapore
This conference will be a major event hosted by the National University of Singapore and will provide a broad forum for researchers to share experience and exchange ideas in fundamental and industrial chemical research. Emphasis will be made to link chemical research to industrial applications. Another key objective of the conference is to foster better interactions and dialogue among researchers in chemistry or related areas in this region.
Contact: Louanne McLeay
Ancat Holdings Limited
P O Box 38-546, Howick, Auckland
New Zealand
Tel: (+64-9)-5353475
Fax: (+64-9)-5353476
Email: ancat@ihug.co.nz

3-7 July 1999
IV Liquid Matter Conference
Venue: University of Granada, Spain
The Conference is sponsored by the European Physical Society and the University of Granada. The scope of the IV Liquid Matter Conference is rather broad and the program is based on

the following twelve Symposia, entitled: simple liquids and solutions, classical and quantum; molecular liquids and reaction dynamics; ionic liquids and liquid metals; liquid crystals; polymers, polyelectrolytes and gels; colloids, surfactants, eulsions and foams; membranes and biological liquids; fluids in confined geometries, films and interfacial phenomena; supercooled liquids and glasses; phase transitions and nucleation phenomena; rheological properties of liquids; and powder and other granular matter.

Contact: Professor Dr Roque Hidalgo-Álvarez
Departamento de Física Aplicada
Universidad de Granada
Campus de Fuentenueva
E-18071 Granada, Spain
Tel: (+34-58)-243213
Fax: (+34-58)-243214
Email: liquid99@ugr.es
Web Site: http://www.ugr.es/~liquid99

December 1999
23rd Australian Polymer Symposium
Venue: Geelong, Victoria, 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.monash.edu.au

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

14-18 August 2000
12th International Conference on Thermal Analysis and Calorimetry
Venue: Copenhagen, Denmark
Contact: Dr O Toft Sorensen
Risoe National Laboratory
Fax: (+45-46)-351173

14-19 December 2000
Pacifichem 2000
Venue: Waikiki, Honolulu, Hawaii
Contact: Professor B Halton
Chemistry Department
Victoria University
P O Box 600, Wellington, New Zealand
Fax: (+64-4)-4955241
Email: brian.halton@vuw.ac.nz

IUPAC-SPONSORED SYMPOSIA IN 1998

4 - 7 May 1998
1st International Conference on Trace Element Speciation in Biomedical, Nutritional and Environmental Sciences
Venue: Neuherberg/Munich
Federal Republic of Germany

28 June - 2 July 1998
12th International Conference on Organic Synthesis
Venue: Venice, Italy

6 - 10 July 1998
7th International Chemistry Conference in Africa
Venue: Durban, Republic of South Africa

20 - 23 July 1998
18th Discussion Conference on Macromolecules: Mechanical Behaviour of Polymeric Materials
Venue: Prague, Czech Republic

2 - 7 August 1998
9th International Symposium on Novel Aromatic Compounds
Venue: Hong Kong

5 - 8 August 1998
8th International Symposium on Solubility Phenomena
Venue: Niigata, Japan

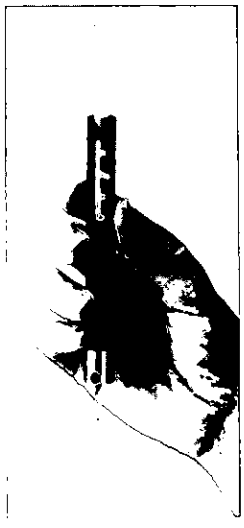
16 - 21 August 1998
14th International Conference on Physical Organic Chemistry
Venue: Florianópolis, Santa Catarina, Brazil

30 August - 4 September 1998
33rd International Conference on Coordination Chemistry
Venue: Florence, Italy

11 - 16 October 1998
21st IUPAC Symposium on Chemistry of Natural Products
Venue: Beijing, China

For further information, please contact:
The NZIC Secretariat
P O Box 38-546, Howick, Auckland
Tel: (+64-9)-5353475, Fax: (+64-9)-5353476
Email: ancat@ihug.co.nz

NEW PRODUCTS



AIR SAMPLING OF VOLATILE ORGANIC COMPOUNDS USING NEW SPME PORTABLE FIELD SAMPLER

With the development of two new products, the solid phase microextraction (SPME) technology from Supelco now can be applied to air sampling and monitoring. These products, a SPME portable field sampler and a SPME fibre coated with 75 µm of Carboxen/ polydimethylsiloxane (PDMS), allow analysis of volatile organic compounds (VOCs) at trace levels.

- The SPME portable field sampler eliminates the need to ship samples from the field to the laboratory. When the needle containing the fibre is sealed by the self-contained septum, there is no loss of analytes from the fibre prior to desorption. Consequently, the fibre need not be desorbed immediately after extraction.

- The Carboxen/PDMS fibre efficiently extracts and retains VOCs at trace levels, yielding good linearity. The pore structure of the Carboxen material enables the fibre to extract a variety of analytes in a complex mixture, with minimal displacement.

For more details request application note 141.

Contact: Patrick Wesley, Supelco
Sigma-Aldrich Pty Ltd
P O Box 12423, Penrose, Auckland
Free Phone: 0800 936666, Free Fax: 0800 937777
Email: sigmaa@ibm.net
circle number 23 on the reader reply card

SPECTROPHOTOMETER STANDARD - SPECTROSOL

The sophistication of modern spectroscopic techniques demands solvents, reagents, and standards of high purity. BDH offer a Holmium Perchlorate standard solution 'SpectrosoL' for the calibration of spectrophotometers. (Refer the National Bureau of Standards (NBS) special publication 260-102).

It is available as a 5% solution of holmium oxide in 1.4 N perchloric acid (catalogue number 14119 2H (100 mL) and is available from your BDH distributor or direct from BDH Chemicals New Zealand Ltd.

For further information
Contact: Craig Trembath, BDH Chemicals NZ Ltd
Phone: 0800 4 Analar (0800 426252), Fax: (06) 3567311
Email: bdhnzl@xtra.co.nz
circle number 24 on the reader reply card

ACCELERATED SOLVENT EXTRACTION (ASE) RECEIVES FINAL APPROVAL FOR HAZARDOUS WASTE MONITORING

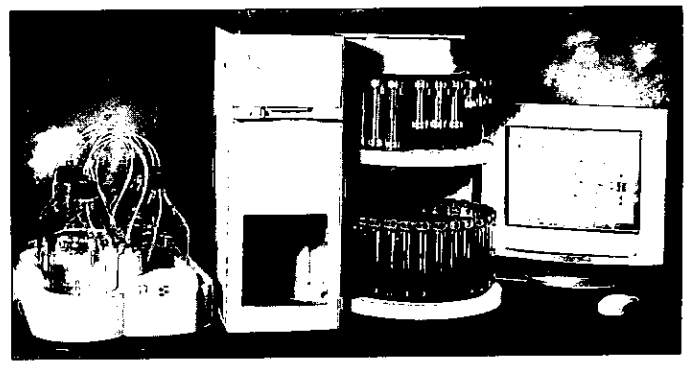
United States Environmental Protection Agency (USEPA) Method 3545 titled 'Pressurised Fluid Extraction (PFE)' has been approved for the monitoring of hazardous waste materials.

The announcement promulgating Update III of the United States Environmental Protection Agency's SW-846 Method Manual for hazardous waste monitoring appeared in the Federal Register on June 13, 1997 (Volume 62, Number 114, page 32451). Update III includes Method 3545, which was developed by Dionex using the ASE 200 Accelerated Solvent Extractor.

The ASE 200 uses solvents at elevated temperature (100 °C) and pressure [10.3-13.8 MPa (1500-2000 psi)] to achieve analyte recoveries equivalent to those from Soxhlet extraction, but in a much shorter time (< 15 minutes) and using significantly less solvent (< 15 mL/g). The ASE 200 was the only extractor used to develop the data necessary to validate this method.

Method 3545 has been validated for the following compound classes:
- Semi-volatiles (BNAs), including PAHs
- Organophorous Pesticides
- Organochlorine Pesticides
- Chlorinated Herbicides
- Polychlorinated Biphenyls.

The validation data confirms reliable recoveries of these compound classes in a variety of solid matrices, such as soils, clays, sediments, and solid waste.



ASE family (left to right): Solvent Controller, ASE 200 Extractor, and AutoASE.

Contact: Mark Albertson, A.i. Scientific (NZ) Ltd
P O Box 35579, Browns Bay, Auckland
Phone: (09) 4784967, Fax: (09) 4781360
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PORTABLE AND BENCH INSTRUMENTS FOR WATER ANALYSIS

The WTW (Germany) range of measuring and analytical instruments are now available through BDH Chemicals New Zealand Ltd. The range includes models to measure pH, conductivity, dissolved oxygen, BOD/COD, as well as multi-parameter instruments.

Both water-proof (IP66) and submersible (IP67) models are available. New models now include datalogging capabilities. Accuracy, reliability, and robustness are the hallmarks of the WTW range of instruments.

For further information
Contact: Craig Trembath, BDH Chemicals NZ Ltd
Phone: 0800 4 Analar (0800 426252), Fax: (06) 3567311
Email: bdhnzl@xtra.co.nz
circle number 26 on the reader reply card

AQUANAL-PLUS WATER ANALYSIS PRODUCTS

Riedel-de Haën, the newest member of the Sigma-Aldrich family, has a range of water analysis products called AQUANAL-plus.

The AQUANAL-plus range comprises an extensive assortment for complete colourimetric/titrimetric test sets for rapid analysis of water. Each test set contains all the reagents and auxiliary agents required to carry out the test, enabling water to be rapidly analysed in the field.

The advantages of AQUANAL-plus test sets are:
- *Speed* Measurement results in 5-10 minutes.
- *Sensitivity* Detection limits are generally below 1 ppm.
- *Practical* High purity distilled water enables the measuring range to be extended in the field.
- *Reliability* Check solutions enable results to be checked.

Reagents, check solutions, distilled water and accessory kits are available individually for replenishing test sets.

To find out more about the Riedel-de Haën AQUANAL range of products,
Contact: Anna Civadelic, Sigma-Aldrich Pty Ltd
P O Box 12423, Penrose, Auckland
Free Phone: 0800 936666, Free Fax: 0800 937777
Email: sigmaa@ibm.net
circle number 27 on the reader reply card

A SHINING LIGHT ON TOXICITY

Merck's Toxalert system is a new screening method for the simple and rapid on-site determination of toxicity in wastewater, river, stream or lake waters. The test is based on freeze-dried bioluminescent bacteria which when exposed to a toxic sample decreases it's light emission proportionally to the sample's toxicity.

The test is simple to use and rapid (15 minutes). ToxAlert is ideal for tracing toxic sources in many areas including factories, discharges, landfill leachates etc.

For further information
Contact: Craig Trembath, BDH Chemicals NZ Ltd
Phone: 0800 4 Analar (0800 426252), Fax: (06) 3567311
Email: bdhnzl@xtra.co.nz
circle number 28 on the reader reply card

NEW HOLOGRAPHIC 1800 LINE/MM GRATING FOR ALL GBC ATOMIC ABSORPTION SPECTROMETERS

Continuing the tradition of design and manufacturing of high performance Atomic Absorption Spectrometers (AAS) GBC has released an Ebert-Fastie monochromator incorporating an 1800 lines/mm grating for all GBC AAS. In keeping with GBC's 'non-compromise' policy and commitment to continuous improvement, providing GBC's clients with the best analytical equipment available, GBC have implemented this design modification for all GBC Atomic Absorption Spectrophotometers: 932, 933, Prospector, Avanta, Avanta P, Avanta PM, Avanta M and Avanta Σ, plus All 'G' Versions of models listed above.

Since GBC is committed to providing clients with the best value for money equipment this is a standard feature providing research grade optics in all GBC AAS instruments and has been implemented from September 1st 1997.

Why use an 1800 line/mm grating? There are some advantages in using an 1800 line/mm grating:

- Physically wider slits can be used to improve light throughput. Since GBC AAS have monochromators with continuously adjustable slits between 0.2 and 2.0 nm these systems are better optimised to provide greater light throughput.
- The benefit of more light throughput is lower noise and betterprecision. This translates to better detection limits and makes it easier to measure lower concentration samples.
- The change also enabled GBC to implement a software calibration within the Avanta Windows 95/NT application to enhance in-field servicing of monochromators.
- Software calibration of the monochromator could be included in an annual validation procedure if so required.

The combination of this grating with the 333 mm focal length monochromator design provides enhanced light throughput across all wavelengths from 185 nm to 900 nm.

Contact: GBC-AEC (NZ)
P O Box 68330, Newton, Auckland
Free Phone: 0800 428428, Fax: (09) 3600683
Email: 100036.250@compuserve.com
circle number 29 on the reader reply card

SUPELCO CHEMICAL STANDARDS FOR AIR MONITORING

Supelco offers a variety of chemical reference standards for the quantitative calibration of air monitoring and industrial hygiene equipment. These standards are available in both liquid solutions and gaseous blends to accommodate calibration of today's variety of air monitoring and analysis equipment and methods.

Contact: Patrick Wesley, Supelco
Sigma-Aldrich Pty Ltd
P O Box 12423, Penrose, Auckland
Free Phone: 0800 936666
Free Fax: 0800 937777
Email: sigmaa@ibm.net
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MULTI-ELEMENT STANDARD MIXTURES FOR ICP

BDH recognise the need for high quality calibration standards. The BDH range of single element ICP standards is complimented by a range of ICP multi-element and quality control standards. Up to 23 individual components are available in one mixture. BDH can also quote on providing user-specific multi-element standards. This depends on the number and the concentration of each component. These are available from your BDH distributor or direct from BDH Chemicals New Zealand Ltd.

For further information,
Contact: Craig Trembath, BDH Chemicals NZ Ltd
Phone: 0800 4 Analar (0800 426252), Fax: (06) 3567311
Email: bdhnzl@xtra.co.nz
circle number 31 on the reader reply card

THE MERCK INDEX ON CD ROM

The Merck Index, 12th edition, is now available on CD ROM. It contains over 10,000 monographs detailing chemicals, drugs, and biologicals.

Users are able to access the data they need quickly by text, structure or substructure search.

The CD ROM also provides you with the tools to draw the structure you are interested in on the screen and search for it.

Powerful searching is possible using the chemical, generic or brand name; molecular weights and formulae; physical and toxicity data; citations to the scientific and patent literature.

The Merck Index on CD ROM is available in both Windows and Macintosh formats, from your BDH distributor or direct from BDH Chemicals New Zealand Ltd.

For further information,
Contact: Craig Trembath, BDH Chemicals NZ Ltd
Phone: 0800 4 Analar (0800 426252), Fax: (06) 3567311
Email: bdhnzl@xtra.co.nz
circle number 32 on the reader reply card

NEW PHOTOMETERS FOR WASTEWATER ANALYSIS

Merck Germany are now able to offer two new photometers, the Nova 30 and 60, to complement their wide range of water tests.

The new instruments offer the ultimate in ease of use. With the Merck cell tests (all reagents included, only sample needs to be added), the Nova's can automatically recognise the test, calculate the result and display it.

New methods are easily entered using a memo chip which is supplied with each new method. The Nova 60 can measure at up to twelve wavelengths, the Nova 30, six. They can measure either absorbance or concentration.

Both instruments offer RS232 serial interface for computer and printer datahandling. Both models are available as portable (battery operation).

The Nova 60 can measure all of the Spectroquant cell and reagent test range. In addition it offers some individual programming for separate methods.

The Nova 30 can only measure the Spectroquant cell test range.

For further information,
Contact: Craig Trembath, BDH Chemicals NZ Ltd
Phone: 0800 4 Analar (0800 426252), Fax: (06) 3567311
Email: bdhnzl@xtra.co.nz
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ASTM INVESTIGATES A NEW IC METHOD FOR DISINFECTION BYPRODUCT ANIONS

Dionex's new IonPac AS9-HC (high capacity) column has been included in the ASTM's revised draft method for the analysis of disinfection byproduct anions.

In response to the needs of the drinking water community, the ASTM Committee D19 on Water has been evaluating an ion chromatographic method for the analysis of ionic disinfection byproducts. These ions are chlorite, chlorate, and bromate, as well as bromide, which is a precursor to the formation of bromate.

The original method, which specified the IonPac AS9-SC column, required one analysis to quantify chlorite, chlorate, and bromide, and a second analysis for bromate, which included a sample preconcentration step to reach the desired trace level concentration requirements. The bromate method also required sample pretreatment with three OnGuard cartridges to remove potential interference from high levels of chloride, carbonate, and sulfate, which compromised preconcentration reliability. Each run also required an eluent step change to purge late-eluting ions.

With the IonPac AS9-HC column, the required, µg/L level sensitivity for chlorite, chlorate, bromate, and bromide can be achieved in one run and requires neither OnGuard cartridge clean-up, preconcentration, nor an eluent step change. A chromatogram illustrating the performance of this column is shown in Figure 1.

Columns:	IonPac AG9-HC, AS9-HC, 4 mm		
Eluent:	9.0 mM Sodium Carbonate		
Flow Rate:	1.0 mL/min		
Inj. Volume:	200 µL		
Detector:	Suppressed conductivity, ASRS™-11, AutoSuppression™ external water mode		
Peaks:	1.	Fluoride	1.0 mg/L (ppm)
	2.	Chlorite	0.01
	3.	Bromate	0.005
	4.	Chloride	50.0
	5.	Nitrite	0.1
	6.	Bromide	0.01
	7.	Chlorate	0.01
	8.	Nitrate	10.0
	9.	*o*-Phosphate	0.1
	10.	Sulfate	50.0

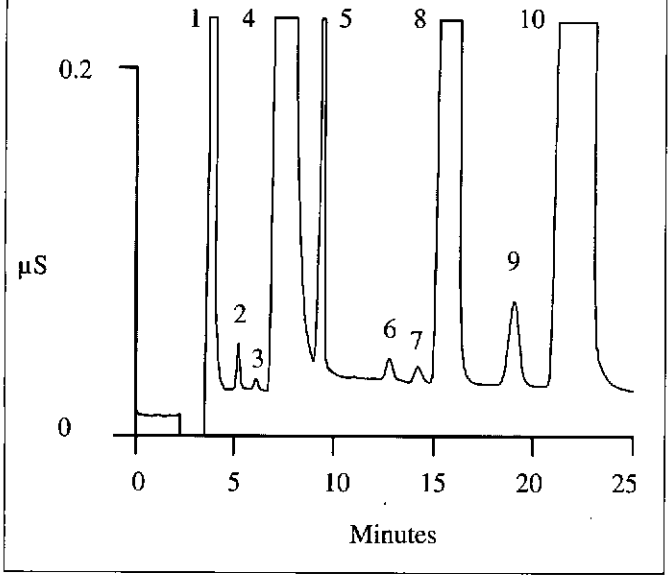

Figure 1. Determination of trace levels of oxyhalides in drinking water using the AS9-HC column.

Contact: Mark Albertson, A.i. Scientific (NZ) Ltd
P O Box 35579, Browns Bay, Auckland
Phone: (09) 4784967, Fax: (09) 4781360
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INTEGRATED SPEEDVAC SYSTEMS THE NEW STANDARD IN SAMPLE CONCENTRATION AND DRYING

New Fully Integrated SpeedVac Systems.
Savant's Integrated SpeedVac Systems set a new standard of convenience and efficiency for sample concentration and drying. Each new SpeedVac System consists of a SpeedVac concentrator combined with a refrigerated vapour trap and an oil-free vacuum pump. There is no complicated set up and no oil to change. Installation is fast, simple, and trouble-free.

Three New Systems.
There are three models from which to choose depending upon the required application. The Automatic Environmental SpeedVac, model AES1000 and the Automatic Environmental SpeedVac, model AES2000, are designed for use with all solvents. A third system, the Integrated SpeedVac System, model ISS100, is designed for laboratories that generally process aqueous and aqueous/organic mixtures.

Minimum Space - Maximum Reliability.
Savant Integrated SpeedVac Systems are designed to occupy a minimum of valuable bench space and provide long, trouble-free service under the most demanding laboratory conditions.

An Integrated SpeedVac System for Every Application.
Savant SpeedVac Systems are designed for specific laboratory applications. System choice is determined by the sample size, number of samples, the solvent type, and solvent recovery requirements. The following guide indicates the recommended system based upon these criterion.

SpeedVac System	AES2000 with Vapornet	AES1000 with Vapornet	ISS100
Usable Solvents	all	all	aqueous and aqueous/organic mixtures
Solvent Recovery Technology	excellent with Vapornet technology	excellent with Vapornet technology	good
Evaporation Rate	excellent with radiant cover	excellent with radiant cover	good
Maximum Number of Tubes	200 x 1.5 mL or 4 mL (RH200-12)	120 x 1.5 mL (RH120-11)	120 x 1.5 mL (RH120-11)
Maximum Volume	4 x 500 mL (RH4-500)	4 x 100 mL (RH4-100)	4 x 100 mL (RH4-100)

Contact: Labsupply Pierce (NZ) Ltd
P O Box 34-234, Birkenhead, Auckland
Free Phone: 0800 734100, Fax: (09) 4447314
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NEW LITERATURE & MEDIA

EUROPEAN BUSINESS INFORMATION ON MANUFACTURERS AND PRODUCTS AND RUSSIAN SCIENCE NEWS NOW ONLINE

STN International (The Scientific and Technical Information Network), one of the world's premier on-line hosts for scientific and technical information, has extended its wide range of databases to include EUROPEX (information on European manufacturers and products), ABCD (manufacturers and products in Germany), and RUSSCI (Russian scientific news). In addition, STN International has introduced a multi-file SDI feature which provides current-awareness searches with automatic duplicate elimination. The Web-based service STN Easy has been expanded to include two significant research categories in chemistry as well as the rubber and plastics database, RAPRA.

EUROPEX and ABCD inform on European and German companies

The EUROPEX (ABC Europe Production Europex) database provides detailed information on European exporting manufacturing companies. The firms listed originate from 40 European countries including countries of the former Soviet Union and Eastern Europe. For each company the directory database provides name, address, contact numbers, product description and industry classification (ABC industrial groups). Additional information includes details on the company such as bank affiliation, VAT registration number, languages of correspondence, number of staff management positions and partners, where available, telecommunications, incorporation year, and capital. Languages of the database are English and German. EUROPEX presently contains records on approximately 100,000 companies and is reloaded quarterly. Produced by the ABC Publishing Group, Europ Export Edition GmbH, in Darmstadt, Germany, the database is the on-line equivalent to the printed directory *ABC Europe Production EUROPEX*®.

The ABCD (ABC der Deutschen Wirtschaft) database contains descriptions of approximately 80,000 manufacturing companies and their products offered on the German market. Records include company address and contact numbers, product range, and industry classification (ABC industry groups). Further details such as bank affiliation, VAT registration number, languages of correspondence, number of staff, management positions and partners, incorporation year, and capital stock are given, where available. Languages of the database are English and German. The database corresponds to the printed German Buyers' Guide, ABC *der deutschen Wirtschaft*® and is reloaded quarterly. Producer of the database is the ABC Publishing Group, Darmstadt, Germany.

RUSSCI: Scientific and technical news from Russia

The RUSSCI (Russian Scientific News) database provides access to information on scientific and engineering publications, research organisations and libraries in Russia and other countries of the former USSR. RUSSCI is produced by ANDRIGAL Limited, Moscow. The database contains a unique collection of bibliographic descriptions of 2,266 Russian-language journals and periodicals published in Russia and other countries of the former USSR. Coverage back to 1986 includes natural sciences, social sciences, agriculture, engineering, industry journals, military arts, business and economics, trading, culture, etc. The journal segment contains descriptions of journals. Journal titles and subtitles are available in transliterated Russian and translated English. ISSN and CODEN are given in some cases, as well as the editor's name and address. Additionally, the journals are described in abstracts. The journal segment is updated every half year. The article segment includes detailed source information on more than 107,000 journal articles from about 300 journals dating back to 1991. Journal titles are, however, mostly available in transliterated Russian only. Approximately 50% of the article records contain an English abstract. Otherwise the description of the contents is restricted to the English title and very general descriptors (CT field). The article segment is updated monthly. The institutions/libraries segment contains descriptions of 5,096 scientific institutions and libraries of the CIS countries. Information on institutions includes the name, type of organisation, address, telephone numbers, field of research, and publication index. Information on libraries include the name, type of library, address, telephone numbers, types of catalogues available, amount of volumes, rare collections, and special literature.

Automatic SDI now includes multifile feature

An exclusive SDI feature that provides multifile current-awareness searches and automatically eliminates duplicates is now available on STN International. Accommodating an unlimited number of files, the new multifile capability allows users to enter file-specific queries, answer display formats and run frequencies, and to streamline, review and update multifile SDIs. Multifile SDI makes it simple for users to create their own alerting services that automatically remember whether a given reference was retrieved previously, from any of the desired databases. The result is a constantly updated set of unique references. SDIs are tailored to the specific needs of a company and are run in selected databases. In regular intervals, SDIs search relevant databases for the most current information.

More databases now available via the WWW interface STN Easy

STN Easy, a Web-based interface, makes searching and retrieving high-quality scientific information in STN databases easy and convenient. STN Easy customers can now select the Regulated Chemical Lists category in STN Easy to access the CHEMLIST database, which contains more than 200,000 confidential and non-confidential substance records. By selecting the Chemical Catalogs category in STN Easy, users can access CHEMCATS, which contains more than 350,000 commercially available chemicals. For the first time, the combined offerings of more than 200 chemical suppliers are available in one easy-to-use Web-based location. Users of RAPRA will be pleased to learn that the database can now also be accessed via STN Easy. RAPRA contains approximately

570,000 citations to worldwide scientific, technical and trade literature concerning rubber, plastics, adhesives, and polymeric composites. (http://stneasy.fiz-karlsruhe.de)

STN International, The Scientific and Technical Information Network, is jointly operated by FIZ Karlsruhe in Europe, Chemical Abstracts Service (CAS), Columbus, OH, in North America, and by JICST, the Japan Information Centre of Science and Technology in Japan. The STN International on-line service offers worldwide access to databases in science and technology (approximately 200 at present), among them a comprehensive cluster of the world's largest and important patent databases as well as a number of subject-related business databases.

Contact: STN International,
c/o FIZ Karlsruhe, P O Box 2465, D-76012 Karlsruhe, Germany
Tel: (+49-7247)-808555, Fax: (+49-7247)-808259
Email: STNmail: HLPDESKK
Internet: hlpdeskk@fiz-karlsruhe.de
: http://www.fiz-karlsruhe.de

ADVERTISERS INDEX

PACIFICHEM 2000 UPDATE

Pacifichem 2000 will be held in Honolulu, Hawaii, between December 14 and 19, 2000. It will follow a similar format to the highly successful meeting held in 1995. The organising committee met in mid-December 1997 to assess the many proposals received in the first round. About 135 proposals were accepted and these will take up about 60% of the available time. While sessions have been allocated for general papers in each area (see below) *proposals for new symposia are needed - can you assist by organising a symposium for the congress?* Two co-organisers each from a different Pacific Basin country are needed to enable the proposal to be considered and it must fall within one of the ten broad areas of chemical science listed below.

Deadlines for proposal submission have been revised and are:

1 July 1998 for consideration in the second round, and **15 January 1999** as the last date for receipt of a symposium proposal for any of the ten areas:

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 (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 & THEORETICAL CHEMISTRY**

Further information and symposium proposal application forms are available from:

Professor B Halton
Chemistry Department, Victoria University
P O Box 600
Wellington

A Life Less Ordinary
Professor Robin Ferrier Retires

(Perhaps plagiarising the title of a lightweight contemporary movie is slightly inappropriate, but..... the movie is about a somewhat eccentric Scottish lad who marries a really attractive American lass and heads off for a happy ending on an island far away. Close enough.)

Professor Robin Ferrier retires from the Chemistry Department at Victoria University of Wellington at the end of January 1998. Robin's chemistry and the people he has educated is a considerable legacy to the scientific community.

Robin arrived in 1970 from Birkbeck College in London to take up the Professorship in Organic Chemistry at Victoria University of Wellington, graciously declining the offer made by careless administrators of an additional post as Professor of Botany.

He had a full head of steam, having already discovered the allylic rearrangement reaction of glycals that has found such widespread utility in carbohydrate synthesis and is now known as the Ferrier reaction, and clarified the mechanism of the Fischer glycosidation. And he had a couple of more than useful PhD students in tow. The relaxed Nada Vethaviyasar appeared "to do chemistry with one hand in his pocket",[1] but he was able to put one of Robin's early glycosidation concepts into practice. Professor Sir Derek Barton has described his latter day research strategy as the *invention of reactions*. This was what Robin was doing. At the time there was no practical route to α-glycosides; what was wanted was a stable α-glycosyl donor that you could have in a bottle on the shelf. Using the affinity of mercuric ion for sulfur (or sulphur as it was then known) the normally stable phenylthio-α-glycon could be activated as a leaving group for a displacement with inversion in the absence of a participating group at O-2, as shown in Figure 1.[2] The reaction was sluggish with complex acceptor alcohols, and has not seen great use, but the concept caught on. Better thiophilic activating agents were subsequently developed in Europe and the USA, and thioglycoside donors are now called upon frequently. The author was charged with making just this discovery for his PhD project, and is certainly responsible for missing this particular boat!

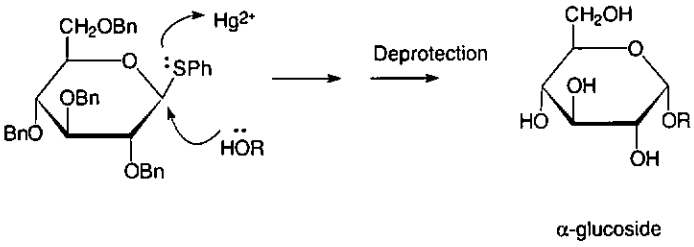

Figure 1

The other imported PhD student was Geoff Bethell, a northern pom with attitude. He and Robin accomplished a rather dramatic re-organisation of a sugar molecule, effectively pouring ethanethiol in at the reducing end of a sugar and having it shuffle down the chain via episulfonium intermediates, replacing the hydroxyl groups at C-1, C-2 and C-3, not to mention C-6, as illustrated in Figure 2.[3]

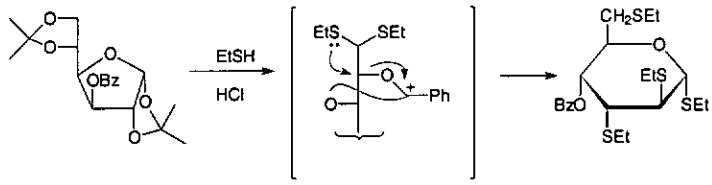

Figure 2

I cannot hope to relate all the clever chemistry Robin has had a hand in, but I have concocted a set of rules that characterise Robin's attitude to his life's work.

Rule 1 **Integrity and Commitment**

Sir Donald Bradman, after being interviewed for an hour on the highlights of a life filled with extraordinary cricketing accomplishments, was asked what he would wish to be remembered for. The answer, integrity. The headmaster of Wellington College, Mr Moses, at last year's 7th form prize-giving ceremony reminded the boys that their integrity was what they would most need as they went through life. And it is this word that most comes to mind when I reflect on Robin's approach to life. That and his utter commitment to chemistry.

Rule 2 **"This is not a monastery!"**

A quote in defence of students working with evil smelling mercaptans. It was great that so many of us had the opportunity to work with such materials and to learn to love the pungent aroma of these fine volatile materials. The 1970s were the days of student activism and a controversial meeting of rich Asian businessmen was unwisely held in the student cafeteria. They departed disgruntled, heckled and forever, when confronted with just such a nasal challenge; fortunately "Prof" was unable to identify the residues of odorous material contained in the fragments of the broken vial that was certainly responsible. I for one, however, could do without ever again smelling those vile cyclopropabenzenes that the Halton-led opposition were making a few benches away.

Rule 3 **Make a good plan and hope it goes wrong**

Many of Robin's best discoveries were made by following unexpected observations into uncharted territory. This approach became so reliable, Robin adopted it as a deliberate strategy. One such case was photobromination of carbohydrate derivatives, in which a proton is abstracted and replaced by a bromine atom, often with considerable selectivity and not from the anomeric carbon, the site one might intuitively consider most reactive (see e.g. Figure 3, ref. 4). Thus a radical reaction was discovered while trying to do ionic chemistry. This avenue of research kept Robin and the next generation of students, including Peter Tyler, Regine Blattner, Peppi Prasit, Steven Haines and the author entertained for several years.

A further example is the carbocyclisation reaction shown in Figure 4.[5] This one Robin discovered all on his own while on

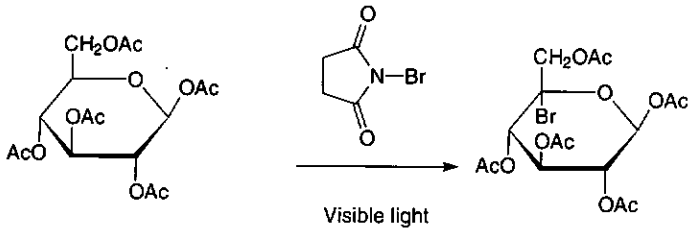

Figure 3

sabbatical leave. I forget what he was trying to do, but the result was spectacular - an Aldol-type reaction under near neutral reaction conditions. This reaction is the second Ferrier reaction, sometimes called the carbo-Ferrier reaction. A "name reaction" comes about through common usage in the literature when a lot of chemists find a reaction is useful and distinct. The carbo-Ferrier reaction has been widely applied in the construction of pseudo-sugars, in which a CH_2 group replaces the ring oxygen atom (e.g. pseudo-α-D-glucose **1**[5]), and the carbocylic moieties of the aminoglycoside antibiotics.

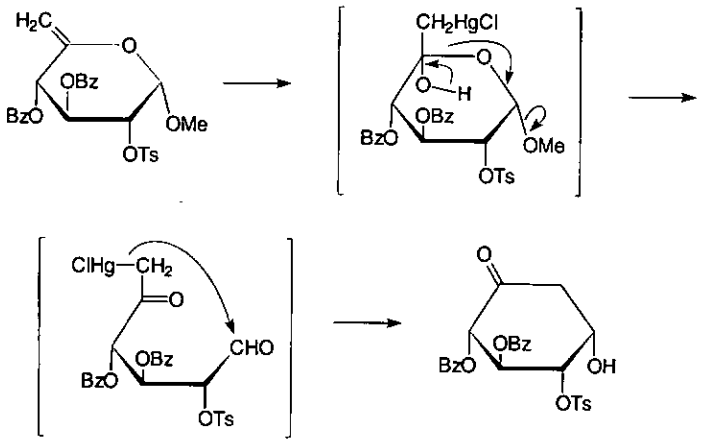

Figure 4

Rule 4 **Look for opportunities where your chemistry can serve**

Robin has heard the call and accepted many such challenges. For the Building Research Association of New Zealand, he and Regine Blattner created a model system - the oxidation of cellobiitol - that elucidated the chemical reactions that cause "nail sickness", an iron catalysed oxidative degradation of the cellulosic component of the wood. For MAF, Robin and Anton Erasmuson made haptens based on synthetic fragments of the fungal *Toxophore sporodesmin*, that were used in making a vaccine against facial eczema in sheep. For DSIR Chemistry, he and Wayne Severn conducted model studies that elucidated the mechanisms involved in a high temperature and pressure biomass liquefaction process developed by Ian Miller. For IRL, he and Anna-Karin Tidèn made the cyclitolamine moiety required for a 23-step total synthesis of the insecticidal natural product allosamidin. Currently, he, Paul Fowler and Manfred Dromowicz are making biologically active sulfated oligosaccharides supported by the New Zealand Cancer Society and IRL, respectively.

Rule 5 **Critical reviews are a good contribution**

Before fax and email, New Zealand seemed much more remote. Robin concluded that scholarly reviews of topical areas would be of great benefit to the chemical community, and that such activity was well suited to our geographic remoteness. He contributed critical reviews on unsaturated sugars, sugar boronate esters, the use of chiroptical measurements, the synthesis of carbocyclic sugars, and radical mediated bromination of carbohydrate derivatives. He was one of three founding "Reporters" for the Specialist Periodical Report "Carbohydrate Chemistry" published annually since 1968 by the Royal Society of Chemistry, taking over as Senior Reporter in 1988. The culmination of this was the complete re-writing, with Dr Peter Collins (United Kingdom), of their book "Monosaccharides", published last year.

Rule 7 **A foreign scientist visiting New Zealand is by definition an interesting person**

Robin and his wife Carolyn have sought to host virtually every organic chemist to visit Wellington on business. In Robin's view, the fact that they come here, so far from home, is already pre-selection - they are likely to be interested and interesting people. How true that has proven to be. What an extra ordinary amount of goodwill their attitude and actions have created for New Zealand chemistry.

Rule 8 **It should always be clever**

In planning his basic research, he has always tried to find clever approaches to solving the problems of carbohydrate synthesis. Mostly he stuck to the carbohydrate patch, but his recent foray into total synthesis of fullerenes (C_{60}) saw his tennis and soccer skills come into play. The molecule in question is made up of the same network of 5 and 6 membered rings found on a soccer ball, and the plan was to put the molecule together by joining two halves in the way a tennis ball is stitched together. With Steven Holden, he got close.

In conclusion

Robin has had an enormous, positive impact on the lives of those who have studied under him. Many are now senior scientists both in New Zealand and overseas. He has a right to be very proud of his achievements, but I know primarily he is grateful to have had the opportunity to use his talents and to serve. Now, in addition to being a Victoria University of Wellington Emeritus Professor, he can be my lab boy at IRL. Nah, but he will be the 3rd IRL Distinguished Visiting Fellow, and will join the IRL Carbohydrate Chemistry team for more fun and games.

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Ferrier, R J and Tyler, P C (1978) *J.Chem. Soc., Chem. Commun.* 1019.

Ferrier, R J (1979) *J.Chem. Soc., Perkin Trans. 1*, 1455.

Dr Richard H Furneaux, Industrial Research Limited, Lower Hutt.

OBITUARY - Werner Giggenbach

The death of Werner Giggenbach on 7 November 1997 of a stroke while climbing a volcano in Papua New Guinea was a sad loss for his family, friends and colleagues. He will be missed for the breadth of his general knowledge, and the depth of his understanding in his chosen field of volcanic and geothermal geochemistry.

Born in Augsburg, Germany, Werner completed his PhD on the chemistry of sulfur in natural minerals, particularly the S_2 radical in lazurite. He was recruited to Chemistry Division, DSIR by A J Ellis in 1968 to join the growing but already successful experimental geochemistry group. This group included Reiner Goguel, Peter Blattner, Akito Koga, Byron Weissberg, Tony Mahon, and Terry Seward as well as the itinerants Ivan Barnes, Frank Dickson, and Al Truesdell. Werner continued with his interest in the chemistry of sulfur/water solution up to 300 °C, publishing papers on the disproportionation of sulfur, polysulfide chemistry, and sulfur isotopes, followed by several others on the role of the sulfur ion radicals in causing the deep blue colour in hot springs. Much of his very early work was laboratory based, and gave rise to high temperature water spectrophotometric cell designs. Field-based geochemistry began in 1970 at Wairakei, participating in regional surveys of several geothermal fields, including Ngawha, and Mokai. His long term interest in White Island dates from this time, when he began monitoring the chemistry of some of the fumaroles. This marked the beginning of his interest in the thermodynamic and compositional relationships between water (and eventually gases) and the rocks at elevated temperatures. He quickly recognised that the existing methods of volcanic gas collection were poor and that many previous gas samples were probably polluted with air. The data rather reflected oxidation of the sample than underground processes. This led to several new collection techniques, including the internationally used Giggenbach bottles.

From 1979 he spent two years in Vienna, working for the International Atomic Energy Agency, evaluating geothermal fields, and the utilisation of geothermal energy. During this period he was involved with the logistic exercises of geothermal exploration in many developing countries. This convinced him of the need for improvements in the quantitative modelling of geothermal systems, including the interpretation of gas analyses. His systematic analysis of volcanic and geothermal gases and their relationship to geochemical and geothermal processes, and the description of these relationships by a rigorous thermodynamic treatment became internationally recognised. To this he added in the mid-1980s the use of isotope ratios in isolating mechanisms, especially of fractionation in hydrothermal settings. In 1987, Lake Nyos in Cameroon underwent a dramatic release of a cloud of CO_2 with the loss of 1700 lives, and Werner entered a vigorous public debate on the processes with the French volcanologist Tazieff. This debate went into recession for several years but eventually reopened in New Zealand with Lake Rotorua seen as a potential cause for disaster. His record shows extensive travel overseas to assess volcanic situations and geothermal developments in many countries, including Mexico, Chile, Colombia, Japan, India, China, and the Philippines. All these trips ended up with large numbers of gas samples and water samples.

In recent years Werner had decided that the gases produced along the convergent plate boundary adjacent to New Zealand reflected the origin of the magmas generated here, and this theme pervaded his recent publications. During the latter part of his career, he covered an ever widening field as it became clear that the methods he had developed for assessing the relationships between gas discharges from the earth and the processes that gave rise to them could be applied also to petroleum chemistry, and the assessment of volcanic risk.

In 1985 he was sent to Columbia, where he predicted the path of lava and mud flows from the Ruiz Volcano, which erupted soon after sending a huge lahar down the route he had plotted.

Since 1992 a senior researcher with the Institute of Geological and Nuclear Sciences at Gracefield, he produced an average of six internationally refereed papers every year, many hailed by the international scientific community for the way they presented new insights in his field. He published over 160 papers. He was appointed a special consultant on volcanoes to the United Nations. Other recognitions included the top MacKay Hammer Award of the Geological Society of New Zealand in 1991, and also in that year Distinguished Lecturer by the Society of Economic Geologists an international body. He was elected as a Fellow of the New Zealand Institute of Chemistry in 1981. He had most recently won a large Marsden Fund award which would have allowed him the latitude to collate and write up the voluminous data collected, and would have preserved his unique style, and extraordinary insights for posterity.

On the other side of his character, Werner could best be described as "quirky". He had little interest in the administration of science, and as a consequence operated for many years as a one man band, sequestering from wherever and whenever he needed it. His versatility was extraordinary, from sampling erupting volcanoes, undertaking complex chemical and isotopic analyses, developing thermodynamic and geological models to being an accomplished equipment designer. He was also a very practised collector of interesting objects, ranging from old chemistry equipment to several old building signs, and the Giggenbach Street sign collected from somewhere in Augsburg. He also was an accomplished cartoonist, illustrating his papers with artistic drawings. He was highly valued as editor of several international journals, best demonstrating his style as the editor of the New Zealand Geochemical Group Newsletter, which he edited from 1977 to 1983. He introduced to this Group a chocolate fish award for the lousiest abstract in the biennial Geochemical Group Conference (the Vacuity Index is calculated from the density of useless expressions in any piece of writing).

New Zealand geochemistry will be the poorer for the loss of his stimulation but will remember him for the richness of his contribution.

Grant Taylor and A J Ellis

(Published with permission from the New Zealand Geochemical Group)

NEW ZEALAND INSTITUTE OF CHEMISTRY

MESSAGE FROM THE PRESIDENT

May I wish all the NZIC members a prosperous and successful 1998. It is my aim that the NZIC continues to develop and evolve to better serve the interests of the members.

Last year changes were made to the membership and fee structure of the NZIC. It was also recognised that the NZIC needed to take advantage of the huge increase in the availability of computers and electronic information transfer. Council worked last year to consider how this could be best implemented. Many of you would have seen the advertisement for a "virtual secretariat" in the September/October 1997 issue of *Chemistry in New Zealand* and the appointment was made at the end of the year.

We are pleased to announce that Ancat Holdings Ltd, the publishers of the NZIC journal *Chemistry in New Zealand* have been appointed the new executive office. They will act as a resource base and contact point for all enquiries from members, branches, and specialist groups. In addition they will handle subscriptions, mailings, and accounts. The incorporation of the executive office into an existing modern business environment should provide distinct advantages for the NZIC.

Rob Whitney, the immediate past president of the NZIC, is the new Honorary Treasurer and will be able implement the financial changes that occurred in his presidency. We are very grateful to Rob for stepping into this position. Grant Boston, from the Manawatu Branch, is the new Honorary General Secretary. Grant has been the secretary and chairman of the Manawatu Branch of the NZIC and has been responsible for the development and maintenance of the NZIC web page on the internet (http://nzic.rsnz.govt.nz).

It is also important to thank those who served the NZIC so generously in the past. Denis Karl, has served for many years as the Honorary Treasurer and though he wished to stand down several years ago, has continued until a replacement was found. Many thanks Denis. Alan Turner was responsible for the creation of the executive office and has acted in the dual role of Executive Officer and Honorary General Secretary. Alan has given a lot of time to the NZIC and has been the source of knowledge as the Council changes. The NZIC owes a lot to Alan's enthusiasm for the organisation and for chemistry and we all thank him for his contribution over the years.

We look forward to the new direction of the NZIC Council and would be most appreciative of any ideas, suggestions or complaints from you as members, as in the final analysis it is your organisation and it is only with your enthusiasm that it will survive and grow.

Alastair MacGibbon
NZIC President 1998

NZIC BRANCH NEWS

WELLINGTON

The Wellington Branch held its last meeting for the year in December 1997 and Professor Carlo Bicchi from the University of Turin, Italy, addressed us on the topic, "Sample Preparation And Chromatographic Methods In The Analysis Of Complex Mixtures Of Vegetable Origin". Professor Bicchi was in New Zealand as an invited speaker to the Pacific Oils 2000 Conference held in Auckland in November 1997. His lecture focused on recent applications of both sample preparation and various chromatographic techniques to the determination of active compounds in plant extracts, with many interesting examples drawn from his own laboratory. Professor Bicchi also interspersed his presentation with several slides giving us a personal glimpse of his home town of Turin in Italy. Although this was a lunchtime meeting at Victoria University, it was very well attended and enjoyed by all. This meeting was also preceded by the National Annual General Meeting of the NZIC.

VICTORIA UNIVERSITY NEWS

Professor Kirpal Singh is currently visiting the School of Chemical and Physical Sciences from the University of Papua New Guinea. Professor Singh is the Dean of the Postgraduate School at the University of Papua New Guinea and has interests in the natural product and environmental areas, as well as course development and senior university administration. In addition to research and general discussions with the staff, he will also be discussing the possibility of students from Papua New Guinea studying Chemistry, Physics or the new BScTech within the School under the New Zealand Government Funded Scholarships, which are available for such students to study in New Zealand. Professor Singh will be with the School until 7th February 1998.

Rod Tilbury

MANAWATU

The Manawatu Branch Annual General Meeting was held in the Cafeteria, New Zealand Dairy Research Institute, on Wednesday 10 December 1997. At the Annual General Meeting, attended by 16 members, Branch Chairman Grant Boston reviewed another active year of scientific and social meetings with some highlights being the launching of a very successful ChemEd '97 conference with the Dead Chemists meeting (previously reported in the July/August 1997 issue of *Chemistry in New Zealand*), the formation of the Taranaki sub-branch, and the continued success of the chemistry quiz for secondary schools in the Manawatu and Wellington Regions. The latter event included a number of entries from other parts of New Zealand, and earned sufficient income to enable $1000 to be donated from the Quiz account to the Manawatu Chemical Education Trust. Grant also acknowledged the work of the Branch Secretary Dr Mark Smales and Branch Treasurer Dr Clyde Smith, both of who were leaving the Branch, Mark to pursue overseas studies in the United Kindom and Clyde to move to Auckland University. Dr Alastair MacGibbon stood down from the committee so as to concentrate on the NZIC Presidency for 1998. At the Annual General Meeting, Dr Tony Wright, Chairman of the Manawatu Chemical Education Trust, reported

on the Trust's activities for 1997. In 1997 the Trust awarded a total of $2300 in grants to 13 secondary schools for chemical education or laboratory materials.

The following Officers and Committee for 1998 were elected:
Chairman:
Mr Grant Boston, New Zealand Dairy Research Institute
Secretary: (to be appointed from the Committee)
Treasurer: (to be appointed from the Committee)
Branch Editor:
Dr Harry Percival, Landcare Research New Zealand Limited

The following committee members were reappointed:
Mrs Kath Fletcher, Central Hawke's Bay College
(Hawke's Bay representative)
Dr Gill Norris, Department of Biochemistry, Massey University
Dr Mark Patchett
Department of Biochemistry, Massey University
Dr Gavin Hedwig, Department of Chemistry, Massey University
Dr Stephen Van Eyk, New Zealand Pharmaceuticals Limited

In addition six new committee members were elected:
Mr Lawrence Scott, Contact Energy
(Taranaki sub-branch representative)
Professor Andrew Brodie
Department of Chemistry, Massey University
Dr Tony Wright, Department of Chemistry, Massey University
Ms Demaris Anderson, Manawatu Beef Packers
Ms Janelle Morgan, Palmerston North Boy's High School
Dr Geoff Lane, AgResearch

The Annual General Meeting was followed by a light meal and then a tour of the refurbished facilities of the New Zealand Dairy Research Institute (NZDRI), guided by Grant Boston. NZDRI currently has a staff of about 260. There is now a new wing housing the administrative centre of the Institute as well as a new cafeteria and new seminar rooms. All other offices and laboratories of the NZDRI complex have been refurbished. Particularly impressive is the substantial pilot plant area with its gleaming arrays of stainless steel equipment. Another impression is of the very significant investment that has been made in chemical analysis equipment of all types, particularly HPLC and GC.

The CEO of NZDRI, Kevin Marshall, has resigned to work full time for the New Zealand Dairy Board. Dr Allan Anderson, previously Section Manager of the Consumer and Applications Science Section has been appointed CEO. Allan will take up his new role on the 1st February 1998.

Wayne Temple, a PhD student working with Dr Tony Burrell and Dr David Officer in the Department of Chemistry, Massey University returned late in 1997 from a month at the Weizmann Institute of Science in Rehovot, Israel. Wayne's visit resulted from an invitation extended by Ron Naaman of the Institute on an earlier visit to Massey. The purpose of the visit was to investigate the viability of using porphyrinic compounds developed at Massey for the role of photosensitising semiconductor devices. Wayne couriered to Israel about 40 compounds that had been synthesised and characterised by himself and others in the Massey research team, then assisted with some preliminary studies into the binding of these compounds to GaAs and silicon semiconductor wafers. Preliminary binding studies were encouraging and currently further laser experiments are being carried out.

Dr Benny Theng, a senior scientist at Landcare Research, Palmerston North, officially retired from Landcare Research in mid-December 1997. His expertise is not lost to Landcare Research however as he is returning on part-time contract for several years starting in 1998. Benny holds a BAgSc (Hons, 1st class), Adelaide (in biochemistry and soil science) and a PhD, Adelaide (in colloid and surface chemistry of clays). He joined New Zealand Soil Bureau, DSIR, in 1970 and has belonged to the successor organisations since then. Benny is internationally recognised for his contributions to clay mineralogy and soil organic matter research. He has made major contributions to the understanding of the colloid and surface chemistry of clays, to clay mineral-organic matter interactions, and has special expertise in the industrial uses of clays. He has written and edited three reference books which have become a standard in their respective disciplines. One of these, "The Chemistry of Clay-Organic Reactions", won the Adam Hilger Prize in 1974. Benny is on the Editorial Board of Applied Clay Science. He was a elected a Fellow of the New Zealand Institute of Chemistry in 1979 and also won the 1979 ICI Prize for excellence in chemical research. He became a Fellow of the Royal Society of New Zealand in 1989. He has been a visiting lecturer and invited speaker at numerous conferences, symposia, research institutions and universities in Asia, Europe, and North America.

Harry Percival

1999 AUSTRALIAN ROYAL SOCIETY OF CHEMISTRY LECTURESHIP

Nominations are called for the 1999 Australian Royal Society of Chemistry Lectureship.

This lectureship, financed by the annual subvention of the RSC to Australia and New Zealand, is held by a New Zealander every fourth year. The 1995 lecturer was Professor Ted Baker of Massey University. The 1996-1997 lecturers were Professors John Ralston from Adelaide and Bob Cattrall from Melbourne. The 1998 lecturer is Professor Mike Paddon-Row of the University of New South Wales.

The lectureship involves lecturing at several Australian and New Zealand institutions. The lecturer will receive $1000 from New Zealand to cover the New Zealand section and return air-fares to Australia. Professor Alan Bond of Monash University, the RSC Local Member for Australia will coordinate the Australian section of the lectureship and payment of expenses in Australia.

The selection panel for the 1999 Lectureship are the three RSC Local Members for New Zealand, John Packer (Auckland), John Spencer (Wellington) and Leon Phillips (Christchurch), and the President of the NZIC.

Nominations should include a Curriculum Vitae, and an account of the work which would be covered. The major part of the work should have been carried out in New Zealand.

Nominations should be sent to:

Associate Professor J E Packer
Department of Chemistry
University of Auckland
Private Bag 92019
Auckland

Nominations should be submitted by 30 June, 1998.

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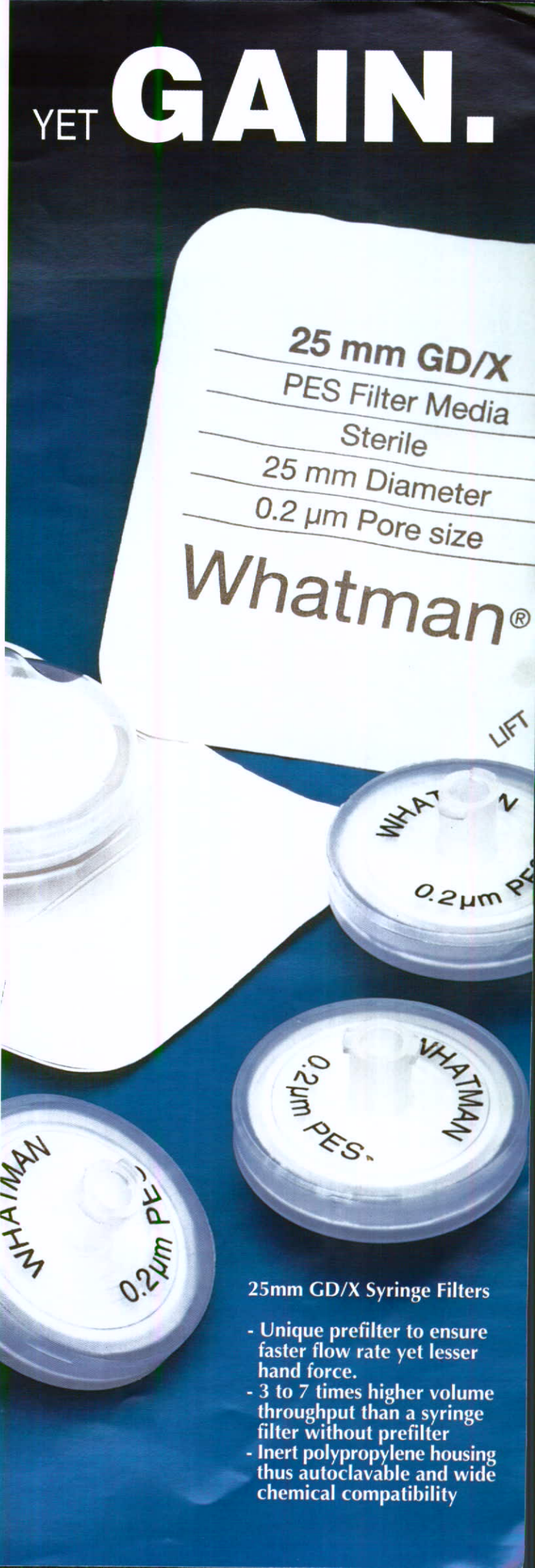

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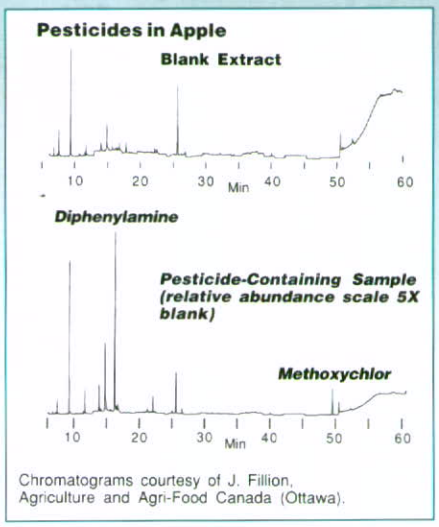

Chromatograms courtesy of J. Fillion, Agriculture and Agri-Food Canada (Ottawa).

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Chemistry in New Zealand January/February 1998

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