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For further details see the cover story on page 2



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## IN THIS ISSUE ...

COVER STORY .....	2
ENVIRONMENTAL ISSUES .....	3
LETTERS TO THE EDITOR .....	4
INTERNATIONAL NEWS .....	6
THIN LAYER ACTIVATION: ON-LINE CONDITION MONITORING OF CRITICAL PLANT By L H Boulton .....	7
CHEMICAL TREATMENT AND COATING OF <i>PINUS RADIATA</i> TO INHIBIT PHOTOYELLOWING By B S W Dawson, F J Cowan, J M Uprichard, Dr Cronshaw & B A Coombridge .....	11
NEW PRODUCTS .....	20
NEW ANALYTICAL TESTING SERVICES GIVE GREATER PEACE OF MIND By Hill Laboratories .....	33
CONFERENCES & SEMINARS .....	34
ROYAL SOCIETY OF CHEMISTRY - RESEARCH & TRAVEL GRANTS & FUNDS .....	38
NEW ZEALAND CHEMISTRY OLYMPIAD TEAM SUCCESSFUL IN OSLO .....	39
NZIC COUNCIL NEWS .....	41
NZIC PRESIDENT'S ANNUAL REPORT .....	43
NZIC BRANCH NEWS .....	45
BOOK REVIEW .....	46
NEW LITERATURE & MEDIA .....	47
CLASSIFIED ADVERTISEMENTS Situations Vacant .....	48
ADVERTISERS INDEX .....	48

## COMING UP ...

**November 1994** - Focus on Mining/Steel/Minerals/  
Geochemistry

**January 1995** - Focus on Environmental Control,  
Waste Management, Consulting Laboratories

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# ENVIRONMENTAL ISSUES



## MOTOR VEHICLE EMISSIONS: BENZENE

Considerable debate is still occurring on the subject of motor vehicle emissions. With the phase down of lead content in petrol and the consequent reduction in total lead emitted, the focus has now centred on the health implications of the emission of benzene from motor vehicle exhausts. The following notes are meant to give some background information on the situation in New Zealand.

Benzene has been identified as a cytotoxic carcinogen with the potential to give rise to leukaemias on prolonged exposure at high concentrations. There is no threshold level at which benzene can be said to have no adverse health effects. There is no consensus among health experts that the risk of getting leukaemia is linearly related to benzene exposure at low levels typical of urban environment.

The major source of benzene in urban environments is from exhaust emissions of petrol driven cars. Some estimates quote that up to one percent of the benzene present in gasoline remains unburnt and forms the major part of the total benzene emitted from the engine. Aromatic hydrocarbons are also an important source of benzene, the latter being formed during partial combustion in the engine. Aromatics are needed in gasoline for their octane enhancing properties.

According to research, benzene in the fuel is a far more important contributor to benzene emissions than the remaining hydrocarbons, contributing 10 to 20 times the quantity of tailpipe benzene emissions as the non-benzene aromatics component in relation to the amounts of each in the fuel e.g. if the fuel contained 3 percent benzene and 40 percent aromatics, each would contribute about equally to the amount of benzene in the tailpipe under normal conditions. It should be noted that benzene does not persist in the environment, but is broken down by the action of sunlight in less than a month.

New Zealand gasoline has an upper limit for benzene of 5.0 percent by mass (4.2 percent by volume). In Europe and Australia the current limit is 5.0 percent by volume. In Japan no limits apply currently, but a 3.0 percent by volume limit will be introduced next year. In the USA limits of one percent apply fairly widely, mainly in urban non-attainment areas. Upper limits on aromatics are rare outside USA. The main reason for these relates to their activity as ground level ozone generators rather than as a source of benzene emissions.

The health risk due to benzene emissions in New Zealand is not known, but is expected to be less than in USA or Europe due to climatic differences and a lower vehicle population.

Although comprehensive data on the benzene content of New Zealand gasoline is available, full compositional data has not been measured. Also currently there is no data on ambient benzene levels in our urban environments.

Concern over ambient lead levels in the environment and its possible implications for health began the drive towards a totally unleaded market. One of the consequences of this is that lead must be replaced by an alternative means for the enhancement of octane quality. Inevitably, this could mean a slight increase in the aromatics content of the premium unleaded grade.

Although the focus at the moment is on the benzene issue, there are important benefits to having a totally unleaded market e.g. the possibility of fitting catalytic convertors to all new cars, thus reducing all potentially harmful emissions.

A A Turner for NZIC Environmental Committee

\* \* \* \* \*



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# LETTERS TO THE EDITOR



5.9.94

20 Miles Avenue  
Papatoetoe

Dear Sir

## Matters of Urgent Concern

Membership: From 1966 to 1988 NZIC membership averaged an increase of 38 per annum. Since 1989 it has fallen from 1601 to about 1300 currently as implied in the July 1994 Treasurer's report. Details of the decline from 1989 to 1993 were published by the President in the January 1994 issue of *Chemistry in New Zealand* in response to a question at the 1993 Auckland AGM. 1300 is about what our membership first reached in 1982.

For comparison the Auckland representative of the RSC has supplied total membership data from RSC Annual Reports as follows:  
1986, 40342; 1987, 40648; 1992, 43506;  
1993, 43816.

Similarly the RACI National Secretariat in a letter dated 24 August 1994 tabulate steady increases from 1986 as follows: 1986, 7918; 1987, 8211; 1988, 8252; 1991, 2.8% increase; 1992, less than 1.2% increase, 1994, 9560.

Cost of Secretarial Service: In 1980/81 NZIC celebrated its Golden Jubilee with a memorable conference. The RSC, RACI and ACS supplied distinguished and interesting speakers. Building on this success Council added to our financial resources by a series of subscription increases. One of the aims of this policy was to provide the means for the appointment of a full time executive secretary.

The thinking was that a paid employee would provide a more complete service to members than that of the dedicated and enthusiastic volunteers (e.g. a Registrar with 28 years service) who established standards of performance. An editorial in *Chemistry in New Zealand*, April 1990 warned Council members that money did not guarantee the high standards of reporting and service to which we were accustomed.

Unfortunately the warning was not heeded, with its implicit responsibility for Council to ensure that service was provided as members expected and not as the employee thought fit. The lack of a quorum at 1989's AGM was notice of members' disinterest in NZIC affairs which becomes more serious as AGM agendas, minutes and Annual Reports are no longer provided in advance, although NZIC rules require these. One wonders why AGM's are held at all. The attendance is now very low and there is no report on them in *Chemistry in New Zealand*.

NZIC's 1987/88 accounts show honoraria and allowances at \$8,903. From 1990 to 1994 the cost of secretarial service was \$200,000 plus \$12,500 for rent paid to IPENZ.

Never in the 60 plus years of our history has so much been paid for so little services of any significance to most members. Surely Council should consider whether Rule 4 is in jeopardy.

In October 1987 two letters to the editor urged council to review the way the needs of members were being met in rapidly changing times. What, for example, has happened to the appointment of a marketing officer by Council in response to these letters? When is the next salary survey planned? On a positive note, the "retirement" of our long serving Registrar has allowed him to volunteer as convenor of Chem NZ. Under his guidance it has become an internationally recognised publication in chemical education.

The Challenge before us: This letter blows the whistle on declining membership, poor secretarial performance, the erosion of members' rights within the rules (refer editions 1964, 1985 and 1992) in favour of executive convenience. There is a need for Council to accept its responsibility as our elected representatives to ensure its paid employee performs to the standards of the past for our statutory requirements in reporting to members and others.

In conclusion, the incoming President and Council are requested to establish a review committee headed by a member of the calibre of the Golden Jubilee President to review the objects of the NZIC, their relevance for the next ten years and any other matters Council considers desirable. In rapidly changing times, ten years allows for outlining an acceptable development policy.

A timetable for this committee's urgent task could be immediate appointment by the President and Council with a request for a report by November for consideration by Council over Christmas, with discussion at its February meeting. The blueprint for our future should be published in *Chemistry in New Zealand* as soon as practicable to allow its consideration by Branches and debate in the Journal, culminating in its adoption at the 1995 AGM and August Council meeting.

Now is the time for action to reverse trends which threaten the life of NZIC. Rome burns. Let's stop fiddling.

Yours faithfully

John Rogers, HonFNZIC.  
Dr J. Rogers

*Dr Rogers raises some important matters. The Council have been requested to respond and this response will be published in the next issue of Chemistry in New Zealand - Ed.*

10 Combes Road  
Remuera  
AUCKLAND 5

10.8.94

Dear Sir,

There is a general perception that the cause of cot death, otherwise known as Sudden Infant Death Syndrome (SIDS) has never been elucidated, despite research in many parts of the world during the past 30 or more years. Certain means have been discovered which reduce its incidence, especially avoiding prone sleeping by babies, but this practice, though moderately successful, is only a palliative. All manner of propositions about SIDS have been put forward and then discarded, and today it seems that most people regard SIDS as they do cancer: just one of those unexplained mysteries. In fact, it is nothing of the kind.

It has been obvious for a decade or more that SIDS is primarily the result of unsuspected and inadvertent poisoning, the consequence of modern environmental pollution. The problem has been to elucidate the actual poison(s), but this was solved some years ago.

I made one discovery about this poisoning but a far more important finding has been made by Mr Barry Richardson, a materials research chemist in Great Britain.

Richardson and his co-workers demonstrated that an unsuspected poisonous gas can be generated by microbiological activity on certain chemicals used as fire retardants and plasticisers in polyvinyl chloride plastic coverings and some plastic foams. Such materials are widely used for babies' mattresses. The same gases can also be generated from the wool on sheepskins (widely used in New Zealand for cot mattresses) and probably from the bark of trees (used by some people in Australia for cot mattress filling).

By contrast, in Japan, where SIDS is virtually unknown, babies sleep on cotton futons, and cotton does not accumulate the harmful elements.

The elements from which the poisonous gases are generated are phosphorus, arsenic and antimony, all of which form the extremely toxic trihydrides, phosphine ( $\text{PH}_3$ ), arsine ( $\text{AsH}_3$ ) and stibine ( $\text{SbH}_3$ ) respectively. Of these the most prevalent are phosphine and stibine.

The propositions that SIDS is related to restricted breathing, or to the inhalation

of excess carbon dioxide, have been completely disproved and a moments study of the world statistics for SIDS makes this apparent. Indeed, it is strange that these obviously erroneous concepts could have persisted for so long. For example, if these reasons were viable, how could it be explained that the SIDS rate in Southland was for some time over 100 times that in Japan?

Richardson's finding is compatible with observation and facts about SIDS as we know it today. The effect of his work upon the SIDS rate in Britain following limited publicity there has been dramatic: a reduction in SIDS of over 85% compared with the rate 6-8 years ago.

It is interesting to note that there were unexplained child deaths (and, indeed, unexplained illnesses among adults) in Italy about the middle of the last century until finally an Italian chemist, Gosio, discovered the reason. The cause was identical to that described above: the microbiological transformation of arsenic dark green pigments (Scheele's Green and Paris Green, both being forms of copper arsenate) into arsine and / or trimethyl arsine. The gas was named "Gosio's arsenic". Such pigments were very fashionable in Italy at that time and were used on wallpapers and in carpets.

After World War II there was another instance of such poisoning, again in Italy. The first United States ambassador to Italy after the war became ill not long after taking up her appointment but no explanation could be found. Eventually it was discovered that she was suffering from arsenic poisoning. The source was located as being arsine generated from the arsenic-based green pigment in her bedroom in the US Embassy building.

For too long the study into SIDS has been left to medical researchers who seem almost exclusively to have sought a medical solution, whereas the true cause lies in the baby's environment.

Yours sincerely,



T J Sprott



## Thieme - IUPAC Prize in Synthetic Organic Chemistry 1994

*Paul Knochel*

*Georg Thieme Verlag, the International Union of Pure and Applied Chemistry and the Editors of Synthesis, Synlett and Houben-Weyl are pleased to announce the recipient of the Thieme - IUPAC Prize, consisting of DM 10,000 which is awarded every two years on the occasion of the IUPAC International Conference on Organic Synthesis (ICOS) to a scientist under 40 years of age, whose research has had a major impact on the field of synthetic organic chemistry.*

The second Thieme - IUPAC Prize will be presented to Paul Knochel at an Award Talk on 12 December 1994 at the ICOS-10 in Bangalore, India.

Paul Knochel was born on 15 November 1955 in Strasbourg, France. After finishing his undergraduate studies in chemistry at the University of Strasbourg, France, he moved in 1979 to Zurich, where he received his PhD at ETH Zurich under the supervision of D. Seebach. From 1982 to 1986 he worked with J. F. Normant at the CNRS, Université P. et M. Curie, Paris, followed by post-doctoral research with M. Semmelhack at Princeton University. In 1988 he became assistant professor

at the University of Michigan, Ann Arbor, where he became a full professor in 1991. In 1992 he accepted a position as C4-professor at the University of Marburg, thus becoming one of the youngest full professors in the field of organic chemistry in Germany.

Professor Knochel's high international recognition is based on his research connected with the synthesis, reactivity, and application of novel organozinc compounds in organic synthesis. Based on his research work at Paris he continued to develop the chemistry of geminal dimetallic compounds and has exploited the different reactivity of both carbon-metal (Zn and Mg) bonds. This led to a new diastereo-selective aldol reaction and to the discovery of a new reaction between the dimetallic compounds and unsaturated malonic esters, which leads to (Z)-olefins with very high stereoselectivity. With the help of mixed Zr,Zn-1,1-dimetal compounds, (E)-olefins with good stereoselectivity could be produced alternatively. It was then that Professor Knochel noticed the tolerance of organozinc compounds for different functional groups, a fact that is of great importance for organic synthesis.

Confronted with the low reactivity of the C-Zn bond, he initiated a research program which led to internationally recognized advancements in this rapidly expanding domain of chemistry. In a broad spectrum of reactions, the transmetallation of alkyl-zinc compounds to mixed copper compounds of the type  $RCu(CN)ZnI$  led to excellent reactivities, where R can be widely varied, for example having cyano, phosphonate,  $\alpha$ -oxygen or  $\alpha$ -boron substituents. Even organozincs with relatively acidic CH protons could be produced. In the meantime these synthetically very valuable copper-zinc compounds have become known as the "Knochel reagents."

Another important step to obtain interesting organozinc compounds was achieved with the direct insertion of zinc into benzyl, aryl and alkenyl halides with zinc powder. Even the corresponding sulfonates could be used for this reaction. Parallel to these tests new reactivities of organozinc compounds were discovered and the reagent  $ICH_2ZnI$ , which had previously been used only to obtain cyclopropanes, was then impressively used as a methylene-homologation reagent of copper compounds. This new method of homologation can be widely used and, for example, permits the diastereoselective synthesis of  $\alpha$ -methylene- $\gamma$ -butyrolactones.

While searching for new ways to produce organozinc compounds, Professor Knochel discovered the iodo-zinc exchange reaction, which for the first time made the production of primary dialkylzinc compounds possible. This is important because these reagents, in the presence of catalytic amounts of chiral titanium compounds, add to aldehydes with high enantioselectivity. Via this method a series of functionalized secondary alcohols with high enantiomeric excesses were obtained. Within the same range of tests palladium- and nickel-catalysed halogen-zinc exchange reactions were also discovered, which permit carbon-zinc reactions to occur via radical intermediates. With these last reactions Professor Knochel entered two additional important fields of chemistry, namely asymmetric synthesis and stereoselective radical chemistry. One can expect many more exciting discoveries from Professor Knochel, especially in the extremely important field of stereoselective catalytic processes.

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# THIN LAYER ACTIVATION: ON-LINE CONDITION MONITORING OF CRITICAL PLANT

L.H. Boulton

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## INTRODUCTION

Corrosion of metals in many process industries is to some extent unavoidable, being one of the time-dependent, life limiting processes that plant operators recognise as being responsible for outages in critical engineering plant. If the corrosion process results in a general surface loss of metal then the life of the plant may be predictable and it may be extended beyond the original design life which, for carbon steel invariably includes a corrosion allowance. If the corrosion damage mechanism involves localised attack such as pitting or stress corrosion cracking, then the lifetime of equipment may be threatened by sudden failure which could have dire consequences for the integrity of the plant.

Although recognised as a useful tool in the control of metal loss in plant, corrosion monitoring is not widely used by industry in New Zealand, with the exception of the petrochemical industries. The reasons why corrosion monitoring is not universally employed include difficulty in implementing representative probes and an acceptance of the practice of "maintenance by replacement". The costs may also pose a disincentive, as the economic climate demands an immediate high return from new or refurbished capital equipment. The installation of costly corrosion monitors and ancillary equipment may be viewed as having a negative effect on the project's cashflow. Inspection and plant conditioning monitoring techniques are usually employed as alternatives to regular monitoring and condition assessment. These procedures can be carried out during an annual shutdown, however, for some critical plant the annual examination has proven to be inadequate in ensuring that corrosion attack is not progressing at an unacceptable rate. Thus, corrosion monitoring systems are sometimes retro-fitted as the result of unforeseen problems.

The management of the corrosion monitoring data obtained must be appreciated by both the operational personnel who control the process and the engineering departments concerned with the plant maintenance. If carefully co-ordinated, the results of a well-planned and conducted monitoring programme can be an extremely valuable contribution to the management system, and ultimately to the production economics. In effect corrosion monitoring becomes an integral component of a planned life extension strategy.

Corrosion monitoring techniques can be categorised as off-line and on-line, the former usually being invasive whereas the latter are non-invasive.<sup>1</sup> Figure 1, summarises most of the plant monitoring techniques currently in use.<sup>2</sup> As yet no ideal technique exists and frequently two or more methods are used simultaneously to extract the maximum information from a

monitoring programme. However, one technique offers advantages over the basic NDE techniques in relation to key characteristics such as simulation of the substrate being monitored, non-invasion and high sensitivity. This method is called Thin Layer Activation (TLA).

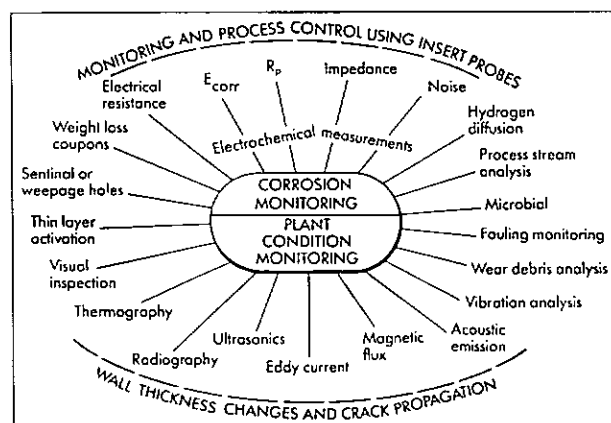
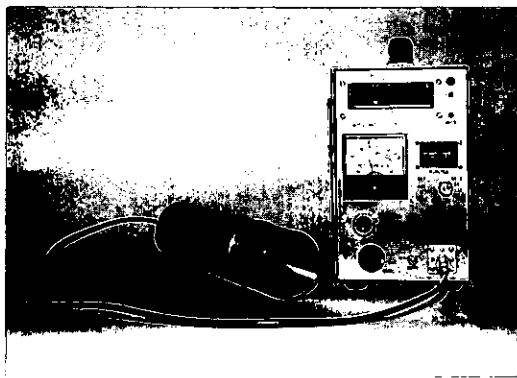


Figure 1. Summary of plant condition assessment techniques.

## THIN LAYER ACTIVATION

TLA is a technique in which a surface is irradiated by a particle beam from a nuclear accelerator and thereby labelled with an accurate depth profile of very low radioactivity. By monitoring this activity it is possible to calculate how much of the surface has been removed by erosion and/or corrosion.<sup>3</sup> As the radioactivity is marked by the emission of penetrating gamma rays it is possible to monitor this metal loss remotely through several centimetres of steel. Coupons, probes and plant components can be activated and as long as the radioactive products are transported away from the site, by erosion, corrosion or wear then the activity level, which may be measured continuously and remotely, after correction for radioactive decay, can be directly related to surface loss of material. Most applications have involved the use of high energy proton beams to convert  $^{56}\text{Fe}$  to  $^{56}\text{Co}$  which naturally decays with a half life of 79 days. The implanted layer is up to 250 $\mu\text{m}$  deep, and may be active for up to two years depending on the corrosion rate. Sensitivity is about 1% of the implanted depth. Duplicate samples of the material are irradiated and after a short "cooling" period, one sample is installed in the plant whilst the other is retained outside the process stream as a reference. This eliminates natural decay and possible detector variations.



*Gamma ratemeter for on-line TLA monitoring*

### CONDITION MONITORING OF A LARGE PRESSURE VESSEL

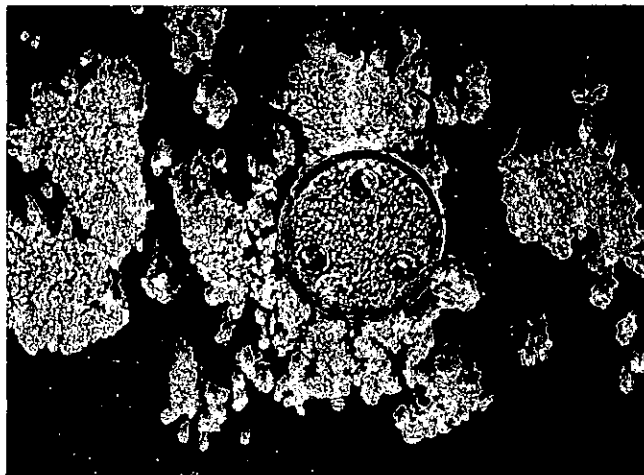
The pulp and paper industry has always suffered from corrosion problems but corrosion-related failures have increased over the years due to the more aggressive processing conditions employed and very stringent environmental requirements being imposed. Erosion-corrosion is one of the uniform types of materials degradation that affects the carbon steel of continuous pulp digesters in the extraction zone where the spent kraft liquor is separated from the wood pulp. This region of these large pressure vessels is subject to a high rate of erosion-corrosion attack because the alkaline-sulfide "black liquor" does not maintain the steel wall in a passive condition whilst being subjected to the erosive wear of the descending pulp "plug" in the vessel. The rate of metal loss from the walls in the extraction zone has considerable importance as it has a bearing on the service life of the vessel. The design life of a steel continuous digester (CD) is normally about twenty years, but by employing various corrosion control technologies, such as weld overlaying with stainless steel, application of thermally-sprayed metallic coatings and installation of anodic protection the vessel life can be extended considerably. Corrosion monitoring techniques provide the CD operators with information necessary to evaluate and quantify the occurrence of corrosion before and after control measures are implemented, to detect process conditions which may adversely affect the service performance of the control programme and to permit the appropriate corrective action to be taken.



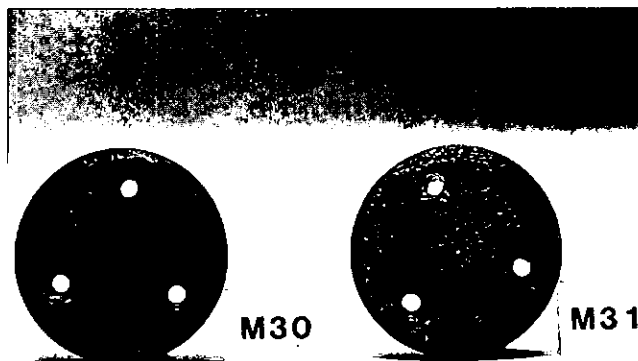
*TLA monitoring in the field*

TLA has been used for the past seven years to monitor erosion-corrosion and general corrosion on three adjacent strakes in the extraction zone of a CD at a pulp mill in New Zealand.<sup>3</sup>

The vessel is 80 metres high, 6 metres in diameter and continuously processes wood chips in a sodium hydroxide-sodium sulphide cooking liquor (pH 12-14) at 170°C and 700 kPa pressure. TLA measures the current and cumulative corrosion rates by remote, on-line monitoring of activated steel coupons strategically located on the inside wall of the vessel. At annual shutdowns measurements of wall thickness and corrosion losses have been made by ultrasonic thickness gauging.



*TLA coupon simulates corrosion on vessel wall*



*TLA coupons recovered from CD vessel*

Spent TLA coupons are also removed for microscopic examination in the laboratory and for weight-loss corrosion rate determination. The agreement between weight-loss, ultrasonic thickness and TLA corrosion measurements is good. TLA has proven to give accurate corrosion rate data (time-dependent) and surface loss data (instantaneous), indicating that the coupons behave in an identical manner to the corroding substrate when in service. This is a result of careful attention to metallurgy of the metals involved and there being no accumulation of corrosion products on the metal surface. A typical plot of the TLA surface loss ( $\mu\text{m}$ ) against time (days) for an array of steel coupons in the extraction zone is shown in Figure 2. The corrosion rates may be determined by linear regression analysis over different periods of the service life between annual shutdowns.

The CD has been retro-fitted with an anodic protection system (AP) which was installed to help minimise corrosion in the extraction zone and thereby extend the operating life of the

digester vessel. TLA has also been employed to monitor the efficacy of the AP system in reducing the corrosion of the digester shell.<sup>4</sup> TLA demonstrated that AP on the large steel pressure vessel is effective in reducing general corrosion, but the process of steel passivation in alkaline-sulfide is improperly understood and the AP system needs monitoring to allow for process chemistry changes, scaling on reference probes and the possibility of electrical malfunctions. Research is currently in progress to improve the understanding of the nature of the passive film on the CD steel wall, using electrochemical impedance spectroscopy. This work will help to improve knowledge of the damage mechanism and it will form part of the feed back loop in the corrosion control programme. With feed-back accumulation of corrosion data, visual examination results, corrosion mechanism, understanding and trend analysis, the means of controlling the corrosion processes are being frequently refined. This refinement of data and information is an essential part of the remnant life prediction approach to life extension of process industry plant.

(by irradiating the internal surface of a pipe spool) and in a large stainless steel-clad heat exchanger suffering from acid attack. Remnant life assessment (RLA) of aging industrial plant and equipment is another area where TLA may be employed. Plant often operates in a mode where time-dependent degradation mechanisms, such as oxidation, erosion, corrosion and wear prevail. Such equipment has a finite life, which may be a factor of 1 to 3 times the design life. Life extensions of these orders of magnitude may be achieved through use of on-line TLA monitoring of metal-loss, combined with reactive maintenance and refurbishment when appropriate. Thus future application of TLA may be seen in the assessment of remnant life of process industry plant which is approaching its design life. With accurate condition assessment information on metal loss, critical plant may continue to be utilised safely well into the post-design life expiry period.

## CONCLUSIONS

The advantages of TLA for critical plant condition assessment are outlined in the chosen industrial examples, namely, excellent simulation of component deterioration determined non-invasively in potentially hazardous systems where erosion, corrosion or wear are the operative damage mechanisms.

TLA is sensitive, suited to both on-line continuous monitoring and short term investigative projects, giving current corrosion rates over a shorter time scale than other invasive techniques.

TLA is a valuable addition to the range of non-destructive evaluation methodologies available to plant engineers which may be incorporated into a planned life extension strategy for critical plant.

## ACKNOWLEDGEMENT

The author thanks NZFP Pulp and Paper Limited, Kinleith Mill, for permission to use the results of the TLA study on a continuous digester vessel.

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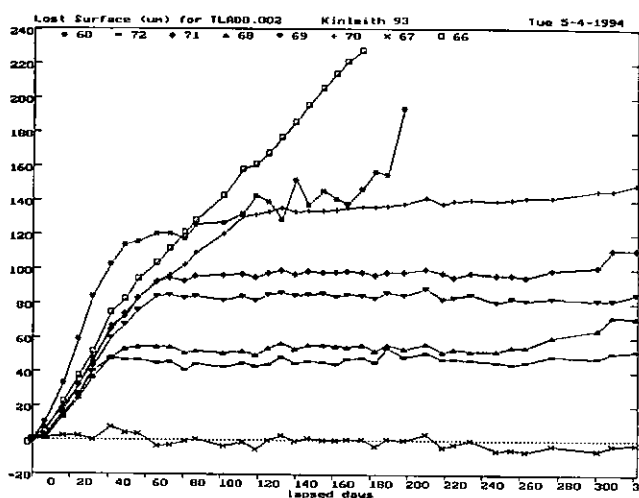


Figure 2. Graph showing TLA measured corrosion losses on a Continuous Digester vessel.

## NEW DEVELOPMENTS

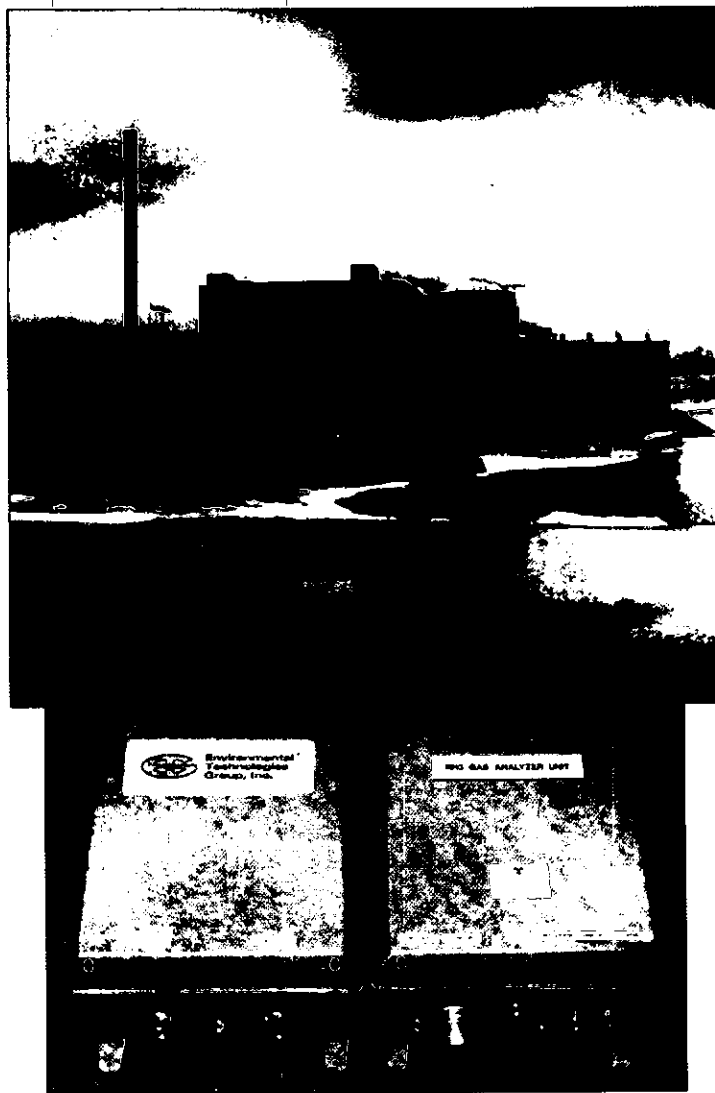
Current research into new applications of TLA are concentrated on detection of localised corrosion attack, particularly pitting corrosion<sup>5</sup> and the monitoring of material loss during high temperature surface degradation processes such as oxidation.<sup>6</sup> The former involves a novel double-layer activation method whereby ferrous metals are activated by deuterons to produce both <sup>56</sup>Co and <sup>57</sup>Co radioisotopes. The <sup>56</sup>Co is produced at a much shallower depth than <sup>57</sup>Co, and the relative rates of loss of activity can give an insight into pitting corrosion behaviour. The potential of TLA to monitor *in situ* material loss due to oxide scale formation and spallation on stainless steel has also been investigated.<sup>6</sup> TLA is a viable technique for measuring surface loss due to thermal oxidation after irradiation of the surface with a deuteron beam. There exists opportunities for this application of TLA in high temperature plant such as boilers and furnaces.

TLA has also been utilised in New Zealand to measure the corrosion rate inside a steel pipeline carrying wet methanol



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# CHEMICAL TREATMENT AND COATING OF *PINUS RADIATA* TO INHIBIT PHOTOYELLOWING

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## ABSTRACT

Samples of *Pinus radiata* were oxidatively bleached with four pretreatments (peroxide, hypochlorite, sodium chlorite and acetylation) prior to subsequent chemical treatment and coating with clear finishes. Samples were then exposed to sunlight behind glass for 170 days.

Oxidative pretreatment affected interior photoyellowing which increased as a function of pretreatment: acetylation < sodium chlorite < hypochlorite < peroxide. It has been shown that peroxide pretreatment does not deplete the surface lignin. Greatest yellowing on irradiation occurred with the peroxide pretreated wood samples. Acetylation on the other hand resulted in a pale yellow lignin-poor surface with acetyl groups instead of phenolic sites; these two factors contribute to the non-yellowing property of acetylated surfaces.

**Keywords:** timber pretreatment, photoyellowing, lignin, coatings, UV irradiation

The primary objective of this work was to investigate the effect of a series of chemical pretreatments on timber surfaces and to assess these surfaces when coated for their tendency to photoyellow in sunlight behind glass exposure situations. Although a number of the pretreatments involved wood bleaching, the main purpose of the treatment was to degrade, modify or reduce surface lignin.

## MATERIALS AND METHODS

### A. Wood pretreatments and chemical treatment-coating systems

Flat sawn, planed and sanded *Pinus radiata* samples (300 x 60 x 8 mm; longitudinal x tangential x radial) were cut into equal sections as shown in Table 1. All the pretreatments and chemical treatments used are listed in Table 2 (*in this report, pretreatment is always used to refer to oxidative or bleaching treatments while chemical treatment refers to the addition of other chemicals such as ultraviolet absorbers, usually after a pretreatment*). Samples were pretreated prior to chemical treatment as described below.

**Table 1** Sample key showing the treatment for each section of the sample.

a	b	c	d	e
Pre-treatment only	Pre-treatment and treatment	Pre-treatment and treatment plus Megathane	Pre-treatment and treatment plus 85syn	Pre-treatment and treatment plus RCAJ

### Peroxide

The estimated requirements for peroxide treatment were:

6 % H<sub>2</sub>O<sub>2</sub>, 5.4 % NaOH, 10 % Na<sub>2</sub>SiO<sub>3</sub>, 0.1 % MgSO<sub>4</sub>, and 0.4 % EDTA based on wood weight. The actual quantities were calculated on the basis of 750g of air dry wood (131 ml of a 34.3 % hydrogen peroxide solution, 375 ml of a 20 % sodium silicate solution, 40.5 g of sodium hydroxide, 0.75g of magnesium sulphate, and 3 g of the sodium salt of EDTA), and made up to a solution volume of 4.25 L. Total sample weight of wood was approximately 850 g. Reaction consistency was approximately 16 percent.

The fifty wood samples were placed in the reaction bath, and the peroxide solution (60°C) added to it. The reaction bath and contents were occasionally mixed over a one hour reaction period. The peroxide solution was then removed from the bath. Two volumes of distilled water were then washed through the samples, which were then treated with a dilute solution of sulphur dioxide in water (pH 3.4) for 30 minutes (end pH 6.4). The samples were then washed with distilled water (3 x 5 litres), individually rinsed and finally air dried in a dark drying cupboard equipped with a fan.

## INTRODUCTION

Water and sunlight are the worst enemies of wood outdoors. Ultraviolet (UV) radiation in sunlight rapidly breaks down wood lignin and causes discolouration. The effect of water and UV radiation on wood eventually causes the slow disintegration of the wood<sup>1</sup>. When wood is used internally, water is a minor factor, except where there is condensation forming at windows and doors.

A finish is usually applied to protect and enhance the appearance of wood. There are two types of finish: film forming finishes such as paints and varnishes and penetrating finishes which include water-repellents and pigmented or semi-transparent stains. Paint provides the most protection<sup>2</sup> of all the finishes available. Paints can be divided into two classes depending on the resin system used: alkyd or acrylic. Alkyd paints are generally more impervious to water than acrylic paints, but the acrylics are more flexible and cope better with the stretching and shrinking of the wood. In timber-lined houses, joinery and furniture manufacturing, durable non-yellowing clear finishes on timber are sought to highlight the natural grain and colour of the wood. Such requirements are not easily satisfied because of photodegradation processes which occur at the wood surface.

A surface pretreatment for wood that gives improved photostability and water repellency has the potential to greatly extend the service life of clear coated wood products<sup>3</sup>. The breakdown of clear coatings on timber is generally due to the degradation of the wood beneath it<sup>4</sup>. Chromium trioxide is an effective treatment<sup>5</sup>, but it is a toxic chemical and there are problems with handling. Chromium trioxide also discolours wood. A clear finish which is durable and stable to photodegradation would be important in the market place.

### Alkaline sodium hypochlorite treatment

Chemical charge was calculated as 7.5 percent hypochlorite ion based on wood weight. Using a nominal weight of 750 g for fifty wood samples the hypochlorite requirement was 56.3 g, or 1.91 litres of a 29.5 percent solution of hypochlorite ion. The hypochlorite solution was made up to a total volume of 4.25 litres. The pH adjusted to 11.3 with NaOH. The wood samples were transferred to the reaction bath (60°C), covered with the hypochlorite solution (pre-heated to 60°C) and occasionally stirred for one hour. The samples were then removed, washed with distilled water, sulfurous acid, and water, as described for the peroxide treated samples and finally air dried in dark cupboard.

### Acidified sodium chlorite

The chemical charge used on wood was 2 %, based on wood weight, and the reaction time was 1.5 hours. For the fifty wood samples treated, nominal weight 750 g, 1.0 litre of buffer solution was prepared from sodium hydroxide (108g), and acetic acid (325 g): this was then adjusted to 4.5 litres. The wood samples were placed in the reaction bath (70°C) and the preheated buffer (70°C) added. After treatment, the samples were washed with water, sulfurous acid and again with distilled water. They were then finally air dried.

### Acetylation

The fifty wood samples used in the acetylation experiments were not end sealed. They were acetylated in batches of ten. They were placed in a wide three-necked 2 L Quickfit flask, evacuated for 15 to 20 minutes, before addition of acetic anhydride (1.4 litres). After addition of acetic anhydride, the vacuum was maintained for a further 30 minutes until the sample sank. The acetic anhydride was heated to boiling point (138°C) and then held at 120°C for two hours. Samples were vacuum oven dried at 105°C until no acetic acid smell was detectable.

### Chemical treatments and coatings

All chemical treatments were 5% (m/v) in the various solvents used (see Table 2) except for the polyethylene glycol (PEG) and ascorbic acid which were 10% m/v. They were all brushed on twice to refusal and air dried. For coating, section c was brush coated twice to refusal with non-yellowing moisture-curing Wattyl Megathane and cured in ambient conditions. Sections d and e of each sample were roller coated (nominal thickness 24µm) with UV curable coatings and UV cured at Whitehall Technical Services, Auckland. The UV curable coatings were 85syn, an aliphatic urethane with a cheap photo-initiator, and RCAJ, a hybrid urethane epoxy acrylic semi-gloss.

### B. Coatings only

The performance of the coatings on untreated wood and colour stable white bathroom tiles was also assessed. The coatings tested were RCAJ, Megathane and Resene HD (a polyurethane used on the interiors of timber-lined houses). The coatings contained various additives: an optical brightener (Uvitex OB; 0.4% m/v), a dye (quinacridin <0.1% m/v), titanium dioxide (3% m/v) and photo-initiators (Table 3).

Table 2 Pretreatments, chemical treatments and coatings used

Pretreatments		
1	Control	
2	Peroxide	
3	Hypochlorite	
4	Sodium Chlorite	
5	Acetylation	
Chemical treatments <sup>1</sup> (m/v)		Solvent
1	5% Tinuvin 171	white spirits
2	5% Tinuvin 328	white spirits
3	5% Tinuvin 384	white spirits
4	5% Tinuvin 900	white spirits
5	5% Tinuvin 384 + 5% Hals 123	white spirits
6	5% Tinuvin 1130 + 5% Hals 123	MEK
7	5% Tinuvin 1130 + 5% Hals 929	MEK
8	10% Ascorbic acid	water
9	10% PEG 400 + 5% 1-octadecanol	chloroform
10	5% Chromic trioxide	water
11	10% PEG 400	water
12	Control	
Coatings		
1	Control	
2	Megathane	
3	85syn	
4	RCAJ	

1 Tinuvin (brand name) are benzotriazole uv absorbers. Hals are hindered light amine stabilisers.

Table 3 Additives used in RCAJ, Megathane and Resene HD on untreated wood surfaces and tiles

Sample Type	Additive
wood/tile	Control
wood/tile	Uvitex optical brightener (OB)
wood/tile	Dye
wood/tile	Titanox
wood/tile	RC34PT (RCAJ only)

### 2.3 Techniques

**Light microscopy.** A Zeiss light microscope was used to view cross-sections. For coated samples the loss of lignin was determined by toluidine blue staining of the cross-sections.

**Colour measurements.** A Technibrite Brightness instrument was used to measure reflectances and brightness, with the x, y, z and brightness filters. Each sample section was measured after an exposure of 170 days. The data were transferred to a spreadsheet and colour changes were assessed using the L\* a\* b\* colour space.

**X-ray photoelectron spectroscopy.** The X-ray photo-electron spectra (XPS) were recorded on a Kratos 800 ESCA/SAM spectrometer using Al K $\alpha$  (1486.6 eV) radiation and a sample chamber pressure of the order of 10<sup>-10</sup> torr. The samples were analysed for the carbon 1s and oxygen 1s peaks and the presence of other inorganic impurities. The carbon 1s peak was deconvoluted to give the binding energy and peak area assignments.

## EXPOSURE AND MONITORING

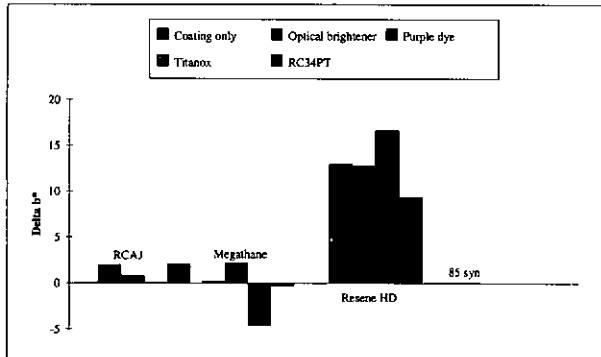
Samples were exposed behind glass, on a north-facing rack inclined at 45° at the NZFRI exposure site in Rotorua.

## RESULTS

The  $b^*$  parameter of the  $L^* a^* b^*$  colour<sup>6,7,8,9,10</sup> space was used to follow colour change since it is proportional to ASTM yellowness<sup>11</sup>. The  $b^*$  parameter is used to measure the yellowness of samples. The use of a single parameter to monitor colour change simplifies data handling. It should also be borne in mind that even a full three coordinate colour space application cannot be a substitute for a spectroscopic monitoring of the samples.

### Coatings on tiles

To separate the effects of discolouration of the transparent coatings from those of the wood beneath it, the discolouration of coatings alone was assessed by monitoring the discolouration of the coatings on white tiles. The studies on coated white tiles (Figure 1) showed that RCAJ, Megathane and 85syn did not yellow after 170 days exposure while Resene HD (a polyurethane) underwent strong yellowing over the same period ( $\Delta b^*$  of approximately 13). The optical brightener in RCAJ and Megathane resulted in  $\Delta b^*$  values of 2 (yellowing just detectable by eye). The presence of the dye had negligible effect on  $\Delta b^*$  for the RCAJ coating but resulted in a noticeable decrease in  $\Delta b^*$  in the Megathane coating and an increase in the Resene HD coating. Titanox had no effect in the RCAJ and Megathane coatings but did reduce yellowing in Resene HD. Resene HD yellowed very strongly in all cases. The RC34PT photoinitiator in the RCAJ coating contributed to a small increase in  $\Delta b^*$ .



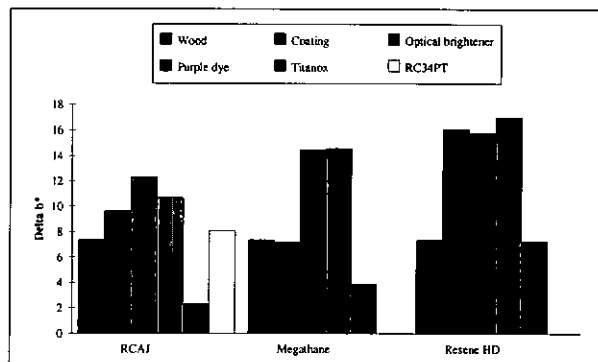
**Figure 1**  $\Delta b^*$  of coatings and additives on tiles after 170 days exposure to sunlight behind glass (note: the RC34PT photoinitiator was only in RCAJ. 85syn has one value and that is for coating only).

### Coatings on wood

The  $\Delta b^*$  values for coatings (RCAJ, Megathane and Resene HD) on wood exposed for 170 days (Figure 2) are greater for RCAJ and Megathane than on the tile since yellowing of the wood surface is the major contributor. The optical brightener and dye were ineffective in inhibiting yellowing and actually enhanced it. Titanox was effective in reducing yellowing by 50 to 70% compared with the coating-only on wood for all three coatings considered. The yellowing of the Resene HD coated surface (with the presence of optical brightener or purple dye) was not significantly different to that of the coating-only on the tile.

These results show that yellowing of wood surfaces continues even when coated with coatings which do not undergo yellowing themselves. The effects of additives in coatings were as follows:

- Titanox maintained a lighter appearance with the limitation that the wood grain became blurred due to the titanium dioxide crystals deposited on the surface
- the optical brightener and purple dye were ineffective and apparent yellowing was not reduced



**Figure 2**  $\Delta b^*$  of coatings and additives on wood after 170 days exposure to sunlight behind glass (note: the RC34PT photoinitiator was only in RCAJ).

### The effect of pretreatment on the yellowing of wood samples

When the wood surface is pretreated prior to exposure to sunlight behind glass, the surface becomes chemically different to that of untreated wood through the alteration of surface lignin structure or a reduction in either the amount of surface lignin or chromophore content.

The pretreatment process caused changes in the colour of the samples. The peroxide samples were the most bleached, followed by acetylated samples, then hypochlorite and finally the sodium chlorite treated samples. The  $L^* a^*$  and  $b^*$  values for peroxide treated samples (Table 4) reflect a surface colour of white with a yellow tinge.

**Table 4** Average  $L^* a^* b^*$  values before and after pretreatment (n=10).

	Peroxide	Hypochlorite	Na chlorite	Acetylation
<b>Before pretreatment</b>				
$L^*$	79.8	79.3	79.3	79.4
$a^*$	3.80	3.82	3.88	3.80
$b^*$	24.4	24.5	24.6	24.5
<b>After pretreatment</b>				
$L^*$	88	80.1	81.1	84.6
$a^*$	-1.3	2.20	1.45	1.40
$b^*$	21.4	12.2	28.7	21.5

Acetylation produced higher  $L^*$  and lower  $a^*$  and  $b^*$  values. While hypochlorite treatment resulted in the greatest decline in  $b^*$ , both  $L^*$  and  $a^*$  did not decline. Sodium chlorite treatment produced a yellower colour (higher  $b^*$ ).

### Assessment of wood pretreatment by phloroglucinol/HCl staining

Treatment effectiveness and the degree of penetration of the pretreatment reagents was examined by transverse cross sections taken from wood samples after treatment. This assessment was carried out using phloroglucinol staining of the wood section and microscopic examination. The staining procedure used is a measure of the coniferaldehyde content of lignin<sup>12</sup>. Hence the absence of the red colour, which is evident in the control samples does not indicate absence of lignin, but rather absence of the coniferaldehyde group.

The phloroglucinol/HCl stain of an untreated sample showed an even distribution of red colour indicating the distribution of coniferaldehyde. The result of the peroxide treatment was a removal or destruction of coniferaldehyde to a depth of 10 to 12 cells. Hypochlorite treatment resulted in a coniferaldehyde removal to a depth of 4 to 6 cells while the sodium chlorite treatment coniferaldehyde removal region was about 8 cells deep. Acetylation is a full impregnation treatment.

### Assessment of the effect pretreatment by X-ray photoelectron spectroscopy

Some of the wood samples were assessed using the technique of XPS spectroscopy. The results obtained in this study are very informative when combined with other information. The oxygen/carbon ratio (O/C) ratio of 0.48 for peroxide pretreated wood (almost white in colour) (Figure 3) suggests that the surface still contains the same amount of lignin but that the chromophores which are responsible for wood colour, for example possibly ortho-quinones, are destroyed in the peroxide treatment. The O/C ratio for the C3 peak decreased significantly in the peroxide pretreated wood. This is in agreement with Castellan *et al.*<sup>13</sup> who found a net decrease in etherified  $\alpha$ -carbonyls and coniferaldehyde groups in peroxide pretreated MWL.

Torr *et al.*<sup>14</sup> found that acetylation of solid wood (Figure 4) resulted in removal of lignin from the surface, probably by dissolution. The infrared spectra of the extracted leachate and acetylated lignin confirmed that the leachate contained acetylated lignin. The cellulose acetate rich surface of acetylated wood is therefore due to the removal of lignin during acetylation.

### Colour changes on exposure to sunlight behind glass for 170 days

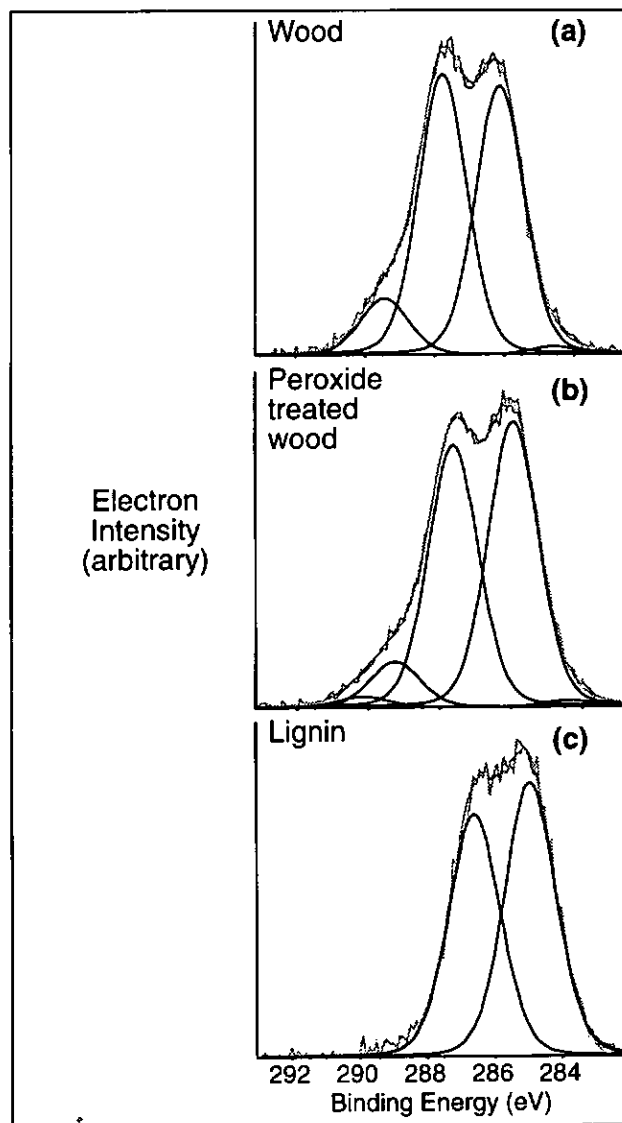
#### Pretreated (but without chemical treatment) and coated samples

The  $\Delta b^*$  value for the wood only control was 7.4 after 170 days exposure to sunlight behind glass (Figure 5). Megathane treatment did not affect yellowing, however, 85syn and RCAJ (both UV cured) resulted in a significant increase in yellowing. Resene HD coated wood had more than twice the yellowing than the untreated control. The peroxide and sodium chlorite pretreated but uncoated samples both had  $\Delta b^*$  values of 10 while the hypochlorite pretreated and acetylated samples yellowed less, having  $\Delta b^*$  values of 2 and 4 respectively. It is unclear why the hypochlorite value was so low.

The coated peroxide and hypochlorite pretreated samples all yellowed more than the wood only control (Figure 5). Except for the Resene HD coating, the sodium chlorite pretreated

samples all yellowed less than the wood control with the 85syn coating system being particularly effective. Coated acetylated wood samples yellowed the least, with the Megathane coated samples bleaching strongly on exposure to sunlight behind glass.

Figure 3 XPS spectra of untreated wood and lignin and of peroxide treated wood (reproduced with permission<sup>15</sup>).

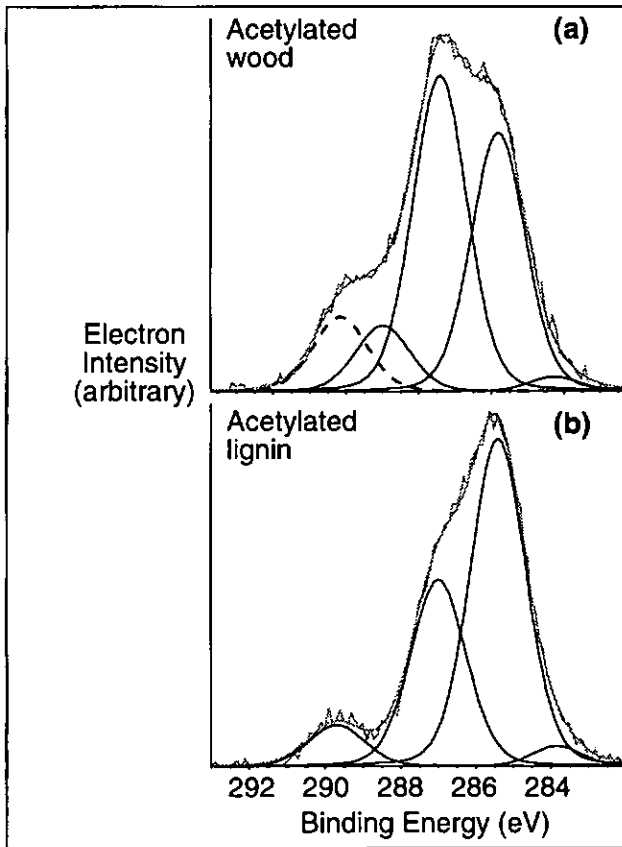


Pretreated, chemically treated and coated wood samples as a function of pretreatment

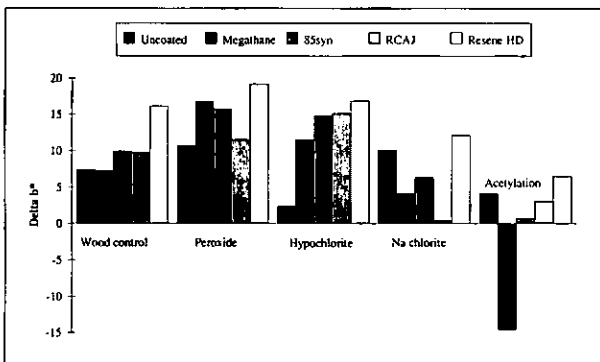
The yellowing in the uncoated pretreated and chemically treated samples (Figure 6) is generally strongest for the peroxide and hypochlorite pretreated samples although yellowing for the ascorbic acid and PEG treated (8 and 11 in Figure 6), hypochlorite pretreated samples is minimal. Sodium chlorite pretreated and acetylated wood yellowed less than wood only controls (yellowing of 7.4) except for the ascorbic acid and PEG/octadecanol treated samples (8 and 9). The  $\Delta b^*$  values for chromic trioxide (10) reflect a change in the green colour of these samples and do not indicate any yellowing change.

When the pretreated and chemically treated samples were coated, peroxide stands out as having the strongest yellowing (Figures 6 to 9) while acetylated samples bleached significantly when coated. In almost all coated samples, the sodium chlorite treated samples yellowed less than the hypochlorite treated samples. Thus yellowing increased with pretreatment in the order: acetylation < sodium chlorite < hypochlorite < peroxide.

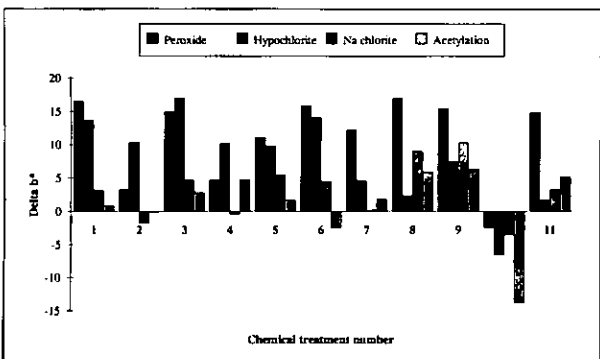
**Figure 4** XPS spectra of acetylated wood and lignin (reproduced with permission<sup>14</sup>)



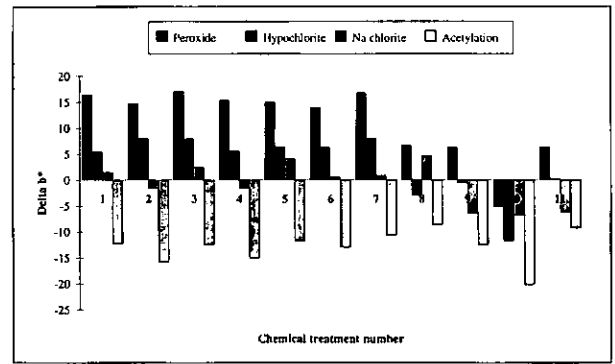
**Figure 5**  $\Delta b^*$  after 170 days exposure of pretreated (but not chemically treated) and coated samples



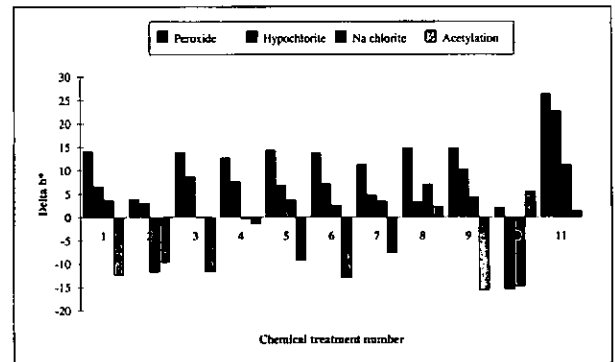
**Figure 6**  $\Delta b^*$  at 170 days for pretreated and subsequently chemically treated wood - uncoated (see Table 2 for treatment key)



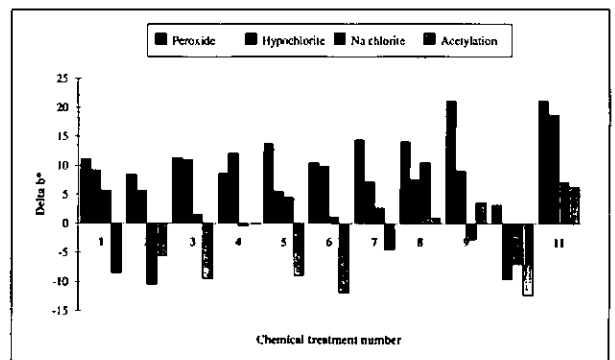
**Figure 7**  $\Delta b^*$  at 170 days for pretreated and subsequently treated wood - Megathane coated (see Table 2 for treatment key)



**Figure 8**  $\Delta b^*$  at 170 days for pretreated and subsequently treated wood - 85syn coated (see Table 2 for treatment key)



**Figure 9**  $\Delta b^*$  at 170 days for pretreated and subsequently treated wood - RCAJ coated (see Table 2 for treatment key)



## DISCUSSION

### *Photodiscolouration of wooden surfaces*

Photoyellowing of wooden surfaces is a complex process. Some important points are:

- chromophores are the structural elements in lignin responsible for photoyellowing.
- there are a variety of pathways for photoyellowing to occur involving oxygen, chromophores and ultraviolet light in free radical reactions.
- the yellow colour is believed to be the result of ortho- and para-quinone formation in highly conjugated aromatic systems.
- photoyellowing is a surface phenomenon.

### PREVENTION OF PHOTO-INDUCED DISCOLOURATION

The attempts to limit photo-discolouration of wood by employing pretreatments, chemical treatments and coating systems has led to varying degrees of success. It should also be borne in mind that the exposure period to sunlight behind glass was just 170 days. However, it is indicative of anti-yellowing performance. Essentially, there were four elements in the approach to limit yellowing in the present study.

#### 1. *Destruction of structures participating in discolouration*

In this category are the pretreatments which destroy the functionalities and precursors of photoyellowing. Peroxide pretreatment left a very light, almost white surface. The XPS data of peroxide treated samples showed that lignin is still present at original levels. The phloroglucinol/HCl staining confirmed that coniferaldehyde had been removed from the surface cells. This implies that a partial lignin breakdown (i.e. coniferaldehyde at least) occurred and that the changes on the sample surface were mainly due to oxidation and destruction of chromophores present on the surface of the sample and was otherwise lignin conserving. Gellerstedt *et al.*<sup>16</sup> reported that pretreated peroxide pulps undergo yellowing, on irradiation, more rapidly than unbleached pulps. Their results with lignin model compounds indicated that the amount of phenolic hydroxides formed on oxidation with peroxide was proportional to the concentration of peroxide used. The increased phenolic hydroxide levels then lead to increased photoyellowing. Increased yellowing on irradiation occurred with the peroxide pretreated wood samples in this study.

It was shown from XPS data that acetylation of solid wood (Figure 4) resulted in removal of lignin from the surface<sup>14</sup>. The cellulose acetate rich surface of acetylated wood, which is very pale yellow-brown, is therefore due to the removal of lignin during acetylation. Ek *et al.*<sup>21</sup> also proposed removal of existing quinone chromophores by a reductive acetoxylation process; this removal of chromophores could also contribute to bleaching of the surface further, enhancing the pale colour due to surface lignin removal. It should be noted that Ek *et al.* worked with pulps which have a higher quinone content as a result of pulp processing.

The presence of lignin remaining in the sample surface following peroxide pretreatment is likely to be the primary cause of peroxide pretreated samples yellowing strongly on exposure to sunlight. Another outcome of peroxide

pretreatment is the introduction of additional carbonyl sites which absorb ultraviolet light strongly leading to chromophore formation. Acetylated samples, which are lignin deficient on the surface, bleach further on irradiation; this has been explained elsewhere by the formation of hydroperoxides<sup>17</sup>.

The intermediate photoyellowing of sodium chlorite and hypochlorite pretreated surfaces probably reflects the amount of delignification that has occurred during the pretreatment process. Sodium chlorite is more effective at delignifying samples and thus yellows less than hypochlorite treated samples. Chlorine dioxide (the active form of sodium chlorite) has been used as a selective oxidant for the phenols present in wood<sup>16</sup>. The oxidation of phenols could lead to quinone formation<sup>18</sup> which would have two results. Firstly, it would produce a yellowing effect on treatment which is consistent with the increased  $b^*$  value on sodium chlorite treatment (Table 4) and secondly it could act to remove a photoyellowing pathway via phenoxy radicals and therefore slow down any further discolouration. This can explain the reduced tendency to yellow of the sodium chlorite treated samples.

The alkaline hypochlorite anion,  $\text{ClO}^-$ , a strong nucleophile, adds readily to quinonoid structures to ultimately result in carboxylic acid type products<sup>18</sup>. This quinone decline is consistent with the large decrease in the  $b^*$  value on hypochlorite treatment.

The various pretreatment solutions are responsible, therefore, for a partial (hypochlorite and sodium chlorite) or relatively complete (acetylation) removal or destruction of surface lignin. In this process some of the lignin chromophores are destroyed. Acetylation blocks phenolic sites while also dissolving some surface lignin. The coniferaldehyde phenyl propane lignin unit is modified by all the pretreatment solutions.

On exposure to sunlight behind glass for 170 days, the untreated coated samples (Figure 5) yellowed. Megathane coating of untreated wood had slightly less yellowing than the uncoated wood most likely due to the ultraviolet absorber content of the coating. The slightly higher  $b^*$  values of the 85syn and RCAJ coating could be due to the radiation curing process facilitating accelerated photoyellowing. The interaction of the coating and pretreatment (Figure 6) is not easily understood. For example why Megathane coated peroxide pretreated wood yellowed strongly while Megathane coated acetylated wood bleached strongly on exposure compared with the other coatings. The possibility of residual bleaching chemicals in the samples cannot be excluded. The voluminous washings may not have removed all treatment chemicals. The only coating which yellowed on exposure on a tile was the polyurethane, Resene HD. This contributed substantially to increased yellowing of wooden surfaces whenever Resene HD was used.

#### 2. *Preventing ultraviolet light from reaching the wood surface*

This approach involves either covering the wood surface with a coating which contained a UV absorber or treating the wood surface directly with UV absorbers. A major drawback with this approach is the instability of the absorbers which themselves eventually yellow. When various Tinuvin UV absorbers and hindered amine light absorbers were applied directly to pretreated timber surfaces, yellowing was found to

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increase generally as a function of the pretreatment in the order: acetylation < sodium chlorite < hypochlorite < peroxide. Tinuvin 328, a benzotriazole, was better than the other absorbers which had relatively comparable performance.

When coatings were included (Figure 6), the Megathane coating was most consistent at restricting yellowing for the hypochlorite and sodium chlorite pretreated and acetylated samples. The bleaching of the acetylated wood samples (i.e. decrease in  $\Delta b^*$ ) in this trial was large (but was only minor when there was no coating). Small decreases in  $\Delta b^*$  on accelerated weathering (at 25 hours) of *Pinus radiata* acetylated wood samples have been observed previously<sup>19</sup>. Photoyellowing of pulps following acetylation is also well documented<sup>20,21</sup>. The presence of a coating in the present study appears very significant. There is also the possibility of residual acetic anhydride or acetic acid leading to enhanced bleaching on exposure to sunlight. The interaction of coating and chemical treatment requires further investigation.

The other chemical treatments (8 to 11 in Figures 6 to 9) were most effective with Megathane also. The application of radiation cured 85syn and RCAJ coatings changed yellowing considerably.

### 3. Scavenging free radicals

Ascorbic acid was the only antioxidant used. It was relatively effective when applied to hypochlorite pretreated but uncoated wood or under any of the coatings.

### 4. Masking photoyellowing

A fourth action taken was not intended to limit photoyellowing but to mask it. Optical brighteners have been employed in a variety of areas to whiten surfaces. Similarly blue dyes have been used to complement colour absorbance due to yellowing. Both of these approaches were ineffective most likely due to the strong wood colour as opposed to a near white substrate colour where previous applications have been (e.g. brighteners for paper or detergents for use on white clothes). The application of finely ground titanium dioxide was, however, very effective. The drawback here though is that a thin whitish film of the oxide covers the sample surface and this may be a detraction from the natural wood appearance.

## CONCLUSION

An important aspect of the interior trial has been the pretreatment of wooden sample surfaces prior to further chemical treatment and coating. This approach has allowed a modification of the surface characteristics of the samples. In conjunction with the non-yellowing coatings used, the pretreatments and chemical treatments have led to varying results. Acetylation with most pretreatments and coatings resulted in a reduction in yellowing on exposure. The acetylation process, however, is not a simple process for using on the production line since acetic anhydride is a dangerous and volatile chemical. Removal of the acetic acid by-product is an old intractable problem. Surface acetylation may be an opportunity to overcome this particular impasse. The use of chlorite based pretreatment solutions may not be environmentally acceptable. Certainly peroxide is an unsuitable substitute in the present situation since wood yellows strongly on irradiation after peroxide treatment. Simplification of the procedures for pretreatment used in this

study could well be achieved. The use of pretreatments shows more potential than the application of either UV absorbers or masking agents. The use of  $\text{TiO}_2$  was effective enough to be considered further.

The future of inhibition of photoyellowing lies in understanding the photoyellowing process and using fundamental chemical technologies to inhibit key pathways. Removal of lignin and chromophores with pretreatments is one approach which merits further work. Another fruitful avenue could be the incorporation of chemicals with chemical functionalities to dissipate radiation on the molecular level through incorporation of chemicals. While coating technology will always be a key component of any system, the bonding of the coating as part of the wooden matrix may be necessary rather than using it as a barrier to the entry of water and radiation.

## ACKNOWLEDGEMENTS

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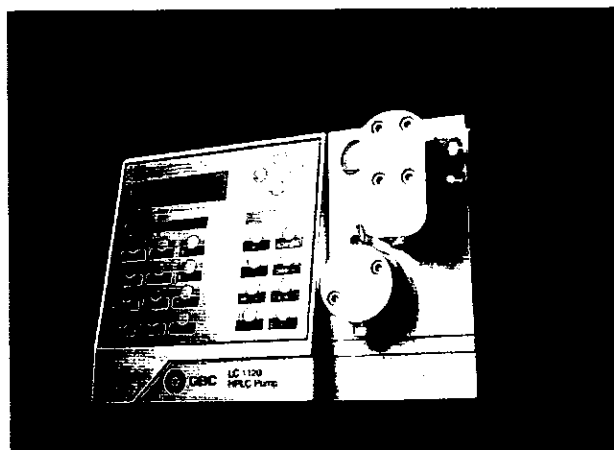
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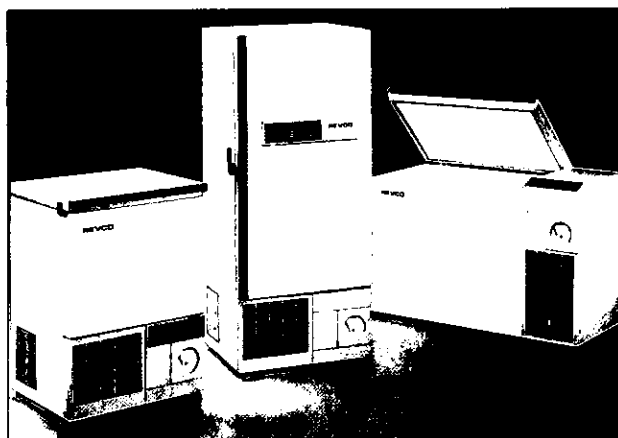
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- \* Comprehensive range of accessories available: acid-resistant insert tub, glass beakers, immersible cooler and many more

Models available:-

LC 20/H	all-stainless steel unit with timer and heater (capacity of half a gallon)
LC 30	a 3-quart capacity, all-stainless steel unit with timer
LC30/H	with timer and heater
LC 60	all-stainless steel unit with timer and drain (capacity of 1½ gallons)
LC60/H	with timer, heater and drain
LC130	all-stainless steel unit with timer and drain (capacity of 3¼ gallons)
LC130/H	with timer, heater and drain
LC S 180/H	with separate generator, welded tank with heater and drain (capacity of 4¾ gallons)

Contact:  
John Morris Scientific Ltd,  
PO Box 6348, Wellesley Street, Auckland,  
Tel: (09) 366-3999, Fax: (09) 366-3060  
or circle number 30 on the reader reply card.

### CCA DETERMINATION: X-RAY FLUORESCENCE - AN ALTERNATIVE TO AAS

The X-MET 820, X-Ray Fluorescence Analyser made by Metorex (previously Outokumpu), has many advantages over standard atomic absorption spectrophotometry when used for chromium, copper and arsenic determination of treated wood. Results are comparable to those gained through AAS methods. A study by Metorex which compares the two methods of determination is available from Douglas Scientific, results are listed in Table 1, which concludes that "in spite of small differences found between the X-MET and the standard methods of determination X-MET is a very useful instrument for quality control of CCA treated wood and solutions. Correctly calibrated it can be used both in laboratories and in treatment plants".

Method	Element	Particle Size (mm)				
		>1.41	1.41-1.00	1.00-0.50	<0.50	Mix
AAS	Cu	2.618	2.626	2.722	3.107	2.683
X-MET	Cu	2.555	2.452	2.566	2.977	2.590
AAS	Cr	3.515	3.608	3.642	4.029	3.633
X-MET	Cr	3.951	3.887	3.928	4.050	4.077
AAS	As	4.474	4.407	4.513	4.750	4.410
X-MET	As	4.279	4.098	4.140	3.996	4.239
AAS	Salt	13.565	13.634	13.914	15.190	13.734
X-MET	Salt	13.935	13.510	13.739	14.163	14.115

The X-MET 820 is a small (57 cm D x 37 cm W x 11 cm H) easy-to-use bench-top analyser. Insert the sample, press a button to start measurement and all analyzed values are displayed simultaneously in seconds. Hard copies of the results are provided by a printer which is a standard peripheral. An RS-232C interface is also available for connection of the analyser to a PC. This allows remote control and storage of results on the computer for further processing using commercially available software such as Excel and Lotus.

The instrument has standard simple test functions which guarantee excellent reliability. Automatic correction for source decay is included.



The X-MET 820 can be equipped with one or two probes (with a Fe-, Cd-, Cm-, or Am- source). Therefore the instrument is capable of analysing all the elements from aluminium to uranium. There can be 24 different programs (calibration models) at a time, each capable of analysing up to six different elements simultaneously. Reprogramming to a different application is also possible. The X-MET 820 can analyse liquid, powder or solid samples.

The size, easy of use and data handling capabilities make the X-MET 820 an attractive alternative to AAS for determination of CCA in wood treatment plants and for many similar applications.

Contact Keith Lewis, Douglas Scientific,  
PO Box 45 027, AUCKLAND 8.  
Ph (09) 837-5447, outside Auckland Ph (0800) 735 725,  
Fax (09) 836 0668,  
or circle number 31 on the reader reply card

## UPCHURCH BOTTLE CAP KITS

For chromatography convenience, Upchurch Scientific has taken several of their inert Tefzel fittings and developed quick disconnect bottle caps. Now your mobile phase tubing can be changed without unscrewing any fittings! What could make this bottle cap any simpler? Try the Upchurch Bottle Cap Kits. Each kit comes complete with a 10 foot length of Teflon tubing, one Quick Disconnect Bottle Cap, Bottom-of-the-Bottle filter assembly, replaceable filter cups and flangeless ferrules and nuts for 1/8 inch OD tubing.

For further information on the Upchurch bottle cap kits or the full range of Upchurch liquid chromatography fittings and accessories contact:

Douglas Scientific, P O Box 45 027, Auckland 8  
Ph: (09) 837 5447, Outside Auckland Ph: 0800 735 725,  
Fax: (09) 836 0668

or circle number 32 on the reader reply card

## ExCell AUTOMATED LIQUID/LIQUID EXTRACTION

The ExCell System from abc Instruments is a fully automated instrument that provides valuable benefits to environmental laboratories requiring rapid, reliable, comprehensive extraction of contaminants from not only "clean" water samples, but also from water samples containing difficult sludge and particulate matrix components. This revolutionary process uses high-intensity electrical pulses to shatter the incoming water sample into micron-size droplets suspended within the extraction solvent. The microscopic droplet size greatly enhances both the speed and effectiveness of the mass transfer of contaminants from the sample into the extraction solvent, for nearly all types of water samples.

Excell was designed for the high volume demands most laboratories face today: to increase sample throughput while enhancing the extraction process with fully automated, reliable results. The ExCell processes six-one litre samples in less than three hours, reducing labour requirements. You simply place one litre samples in the six modules, program the operation, and come back in less than three hours to collect extracts, no turning, no checking, no maintenance.

Excell is also a space saver. At 110cm long, 72.5cm high, and 55cm deep, the instrument requires considerably less space than conventional extraction equipment. The operator gains the additional benefit of being isolated from the volatile, hazardous solvents which are segregated for regulatory compliance or re-purification.

Contact:- Douglas Scientific, P O Box 45-027, Auckland 8  
Phone (09) 837 5447, Fax (09) 836 0668  
Outside Auckland phone 0800 735 725

or circle number 33 on the reader reply card

## THE NEW OPTIFIX® RANGE OF BOTTLE TOP DISPENSERS

For many years OPTIFIX® dispensers have been renowned for their functionality, safety, precision and reliability.

OPTIFIX® now introduce a new generation range of dispensers with models to suit all laboratory applications.

OPTIFIX® *BASIC* - with PTFE coated glass pistons for dispensing aqueous solutions and weak acids.

OPTIFIX® *SOLVENT* - for dispensing organic solvents and other solutions that cause PTFE to swell.

OPTIFIX® *SAFETY*- with PTFE coated glass pistons possessing an extra lip seal on the piston end, and a PTFE valve ball for ventilation. These dispensers are ideal for strong, fuming acids and other media with strong pungent odours.

OPTIFIX® *HF* - both cylinder and piston are made of PTFE for dispensing hydrofluoric acid.

All the new OPTIFIX® dispensers feature a modern ergonomic design and a new volume setting system including an additional fine adjustment control for rapid and accurate volume setting. The corrosion resistant scale rod is made of polypropylene and has graduations on both sides to suit both left-handed and right-handed operators.



Contact: Labsupply Pierce (NZ) Limited, P O Box 34 234,  
Birkenhead, Auckland, Ph. (09) 444 5867, Fax. (09) 444 7314  
or circle no. 34 on the reader reply card

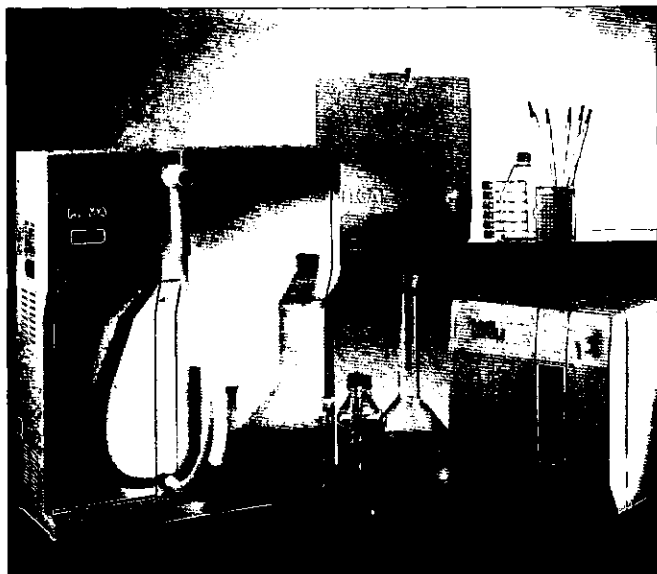
## A CAMPUS REVOLUTION IN WATER PURIFICATION

Distillation is the traditional method of purifying reagent water used in university teaching and research laboratories. But stills not only consume large quantities of energy and water making them expensive to operate and environmentally unfriendly - but are labour-intensive, have low flow-rates and produce water which is insufficiently pure for many modern experimental techniques. Moreover, they represent a health hazard, both because of the concentrated acids used for cleaning and the proximity of water to electricity.

In recent years a quiet revolution has taken place on university campuses - led by Elga, The Pure Water People - in which stills have been progressively replaced by state-of-the-art water purification systems. These systems incorporate technologies such as reverse osmosis, ion exchange, adsorption, ultraviolet photooxidation and microfiltration, and provide purified water which is of higher quality than distilled water and much less expensive to produce.

Leicester University, for example, decided in 1991 to replace every still on both the main campus and Leicester Royal Infirmary with an Elga water purification system. The decision was based on estimates of the cost of distilling water throughout the University in terms of the volume of cooling water run to waste, the electricity consumed and maintenance and depreciation costs. These estimates, together with data gathered

from individual departments, indicated that a major investment in water purification technology was justified. Two of the science departments had obsolete, centralised water purification systems providing feedstock for the stills. These systems were upgraded so that the purified water - which typically has a conductivity 5 $\mu$ S/cm - could be used directly for washing glassware and making up standard reagents. Water required for critical analytical applications is 'polished' to higher levels of purity by Elgastat Option 2 units. These are multiple technology bench-top systems that provide water which is at least equivalent to double-distilled water. Departments without a centralised purified water supply were provided with stand-alone water purifiers or bench-top systems. In total, 71 Option units, together with three cartridge dionisers and three small systems have been installed at Leicester University to supplant the stills.



At Sheffield University, stills in four departments have been replaced by the latest water purification technology. Comprising 13 Elgastat Option units, together with deionisers, reverse osmosis units and a complete centralised system, the Elga equipment provides up to 3,000 litre/day of high-purity water. The rationale for upgrading the water purification systems at Sheffield was the need to save energy and cut costs. Staff reviewed the University's requirements for purified water and estimated the annual energy consumption of the existing equipment before putting the contract out to tender. Calculations showed that the Elga units would save more than £10,000 (NZ\$25,641) per annum in running costs, with a payback period of approximately 33.5 months. The university still-replacement programme marks a sea-change in the use of water purification technology by higher education establishments. In addition to Leicester and Sheffield, Elga has supplied equipment to replace stills at Hull and London Universities, and is currently negotiating similar contracts with other universities and colleges.

If you would like information about how Elga water purification systems may help you and your organisation save money, time and water contact:

Chris Nipper, Douglas Scientific.

PO Box 45 027, Auckland 8

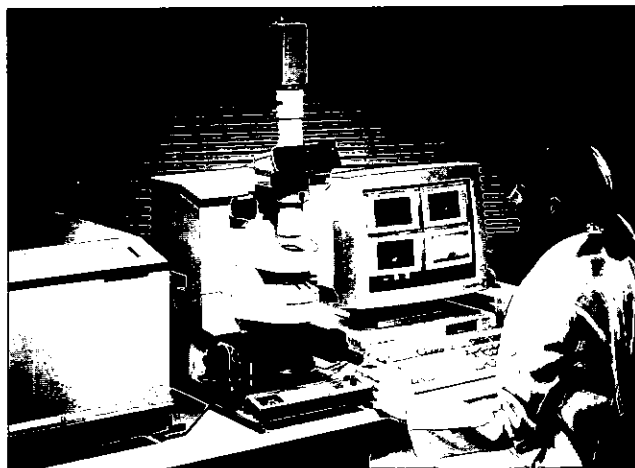
Ph (09) 837-5447, outside Auckland Ph (0880) 735 725

Fax (09) 836-0668

or circle number 35 on the reader reply card

## NEW *i*-SERIES FT-IR MICROSCOPE FROM PERKIN-ELMER

FT-IR microspectroscopy is a potent technique, allowing samples as small as ten micrometers to be visually isolated and chemically identified. The new *i*-Series FT-IR microscope, compatible with Perkin-Elmer's System 2000 and Paragon 1000 FT-IR spectrometers, combines the advantages of superior infrared detection with research-level optical microscopy.



The *i*-Series uses a matched pair of permanently aligned cassegrains for both the infrared and visible path giving a high throughput and ensuring that the area seen is the area measured. For infrared measurements HighLight™ full-field apertures isolate small areas of a sample keeping the whole field in view. A built-in, variable power tungsten halogen lamp illuminates the samples from above or below.

Open access to the sample stage, a working distance of over 20mm, and sensible positioning of controls, allow easy sample handling and effortless change-over from optical to infrared microscopy.

The capabilities of the *i*-Series microscope are extended by adding Perkin-Elmer's unique interactive multimedia IMAGE system. IMAGE combines a motorized stage and live video display of the sample on the PC with a software package to automate FT-IR microspectroscopy. IR and video images are combined in a complete data handling package.

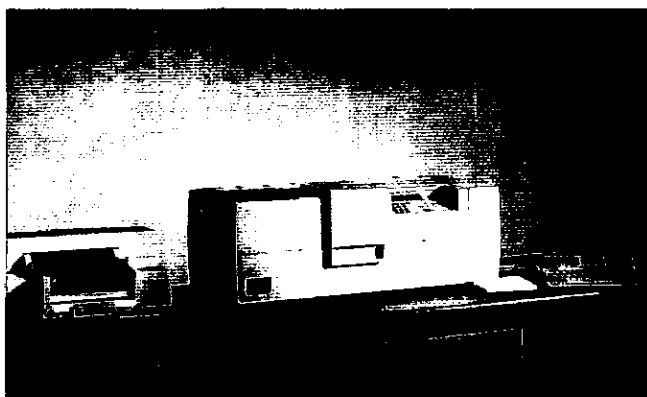
Contact: Perkin Elmer - New Zealand  
P O Box 22-159 Otahuhu, Auckland  
Phone: (09) 276 2230, Fax (09) 276 5602  
or circle number 36 on the reader reply card

## NEW POLARIMETERS FROM PERKIN ELMER

Perkin-Elmer announces the introduction of the Model 341 line of polarimeters. Standing proudly in the tradition of well-reputed Perkin-Elmer precision polarimeters, the Model 341 introduces a new quality in polarimetric measurements.

In the Model 341 family of instruments, the proven optical null principle with automatic rotation of the analyser is combined with completely new state-of-the-art microprocessor electronics. That is to say, we have maintained the critical measuring system, which has been the basis of the excellent reputation of Perkin-Elmer polarimeters, while introducing multiple formats for results, an elegant user interaction, a printer report format meeting all GLP requirements, a

comprehensive set of input/output ports, and many other attractive features. The new instruments therefore offer the highest possible accuracy and precision combined with simple operation and handling; and all that at prices which are substantially below the prices of the Model 241 instrument family which is now discontinued.



The instruments of the Model 341 line have the following attractive features:

- An attractive new design with an integrated touch keypad and a vacuum fluorescence display (2x20 character).
- A motor-driven filter turret; the Model 341 is equipped with interference filters for 589 nm, 578 nm, 546 nm, 436 nm and 365 nm, and there are spare positions for 4 additional filters for UV lines of the mercury spectrum.
- Motor-driven apertures for standard cells and microcells.
- Multiple formats of results; you may display optical rotation, specific rotation, molar rotation, °Z of the International Sugar Scale, and concentration via a user-defined factor and offset.
- At the touch of a key you can display the available energy or the standard deviation calculated during the last integration period.
- A help function gives brief context-sensitive information (e.g. allowed range of parameters, etc.). User interaction is menu-oriented.
- A comprehensive set of input and output ports is provided for various peripheral instruments; this includes a Centronics port for a printer, an RS-232C port for a printer or a data system, a keyboard interface for an optional PC/AT keyboard and/or a barcode reader, an analog output for a chart recorder.
- Inputs and outputs for control signals ("Polarimeter Ready" and "External Auto Zero") complement the extensive capabilities of the polarimeter.
- A complete analytical report may be generated for output to a printer or a data system; the report contains all information relevant for the measurement and thus meets all GLP requirements.
- Alphanumeric information related to the sample (e.g. batch number, sample name, solvent) may be included in the

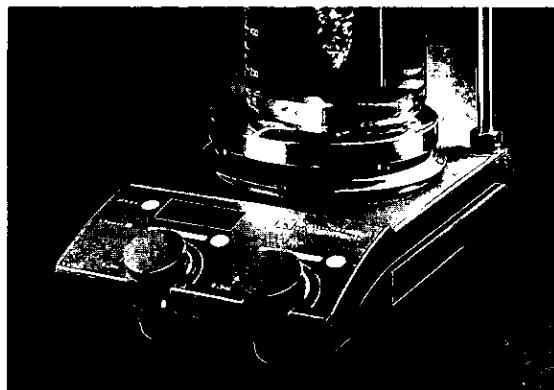
analytical report if an optional keyboard or barcode reader is connected to the polarimeter.

- Supported printers are Hewlett-Packard Laser Jet and DeskJet types, and Epson compatible printers; a straight ASCII output format allows you to print the results on most other commercially available printers.
- A real-time clock (with battery back-up) provides date and time for report printouts and monitors the operating hours of the source lamps.

Contact: Perkin Elmer - New Zealand  
P O Box 22-159 Otahuhu, Auckland  
Ph: (09) 276 2230, Fax: (09) 276 5602  
or circle number 37 on the reader reply card

### THE WORLD'S FIRST MAGNETIC STIRRERS WITH FUZZY LOGIC FROM IKA

IKA have released their new range of IKAMAG Magnetic Stirrers, the first magnetic stirrers/hotplates to feature integrated FUZZY logic control to regulate rotational speed and temperature. These new circuits offer faster heat-up without overshoot and maintain the target temperature within a very narrow range.



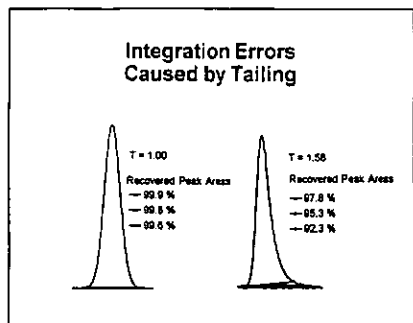
Available in four models: RCT basic, RET basic, RET digital and RET control, the new stirrer/hotplates have an appealing, eye-catching low profile, slim-line design made possible by the latest microelectronic components but incorporating the same high safety standards and reliability that has made IKA famous. All housings are completely enclosed to protect the electronics from corrosive fumes and spilled solvents. Electric sockets are recessed and protected from spills by a housing lip.

Contact: Labsupply Pierce (NZ) Ltd  
P O Box 34 234 Birkenhead, Auckland  
Ph (09) 443 5867, Fax (09) 444 7314  
or circle number 38 on the reader reply card

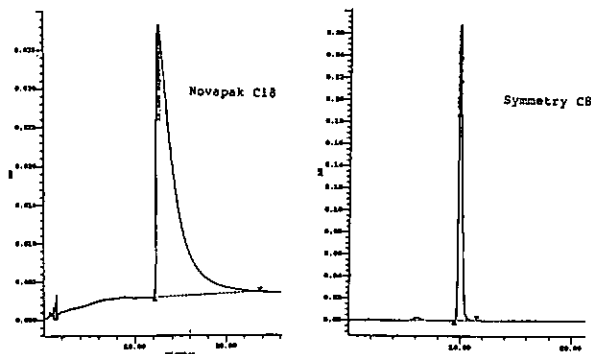
### NEW REGULATORY REQUIREMENTS FOR LOWER LEVEL QUANTITATION DEMAND IMPROVED SYMMETRY™

Poor peak shape leads to errors, variability in quantitation and low sensitivity. Broad tailing peaks deliver low precision and require wider acceptance limits to account for the errors. By using ultra pure silica and the most demanding technical specifications, Waters Chromatography produced Symmetry columns providing unmatched peak symmetry with the following benefits;

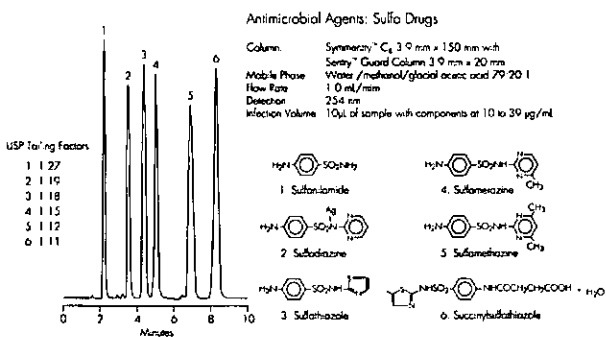
- More symmetrical peaks provide reproducible results permitting narrower control limits.



- Narrower, sharper peaks provide lower detection limits.



- Greater peak symmetry means you'll meet your system suitability criteria consistently. You'll have fewer reruns and be more productive.



systems. The T200 has the interfaces for control and data exchange most widely used in modern data processing:

Two RS-232C serial input/output ports compatible with any PC, a port for commercially available PC keyboards (MF2), optionally an analogue plotter interface and a multifunctional I/O port for remote control and other PC applications.

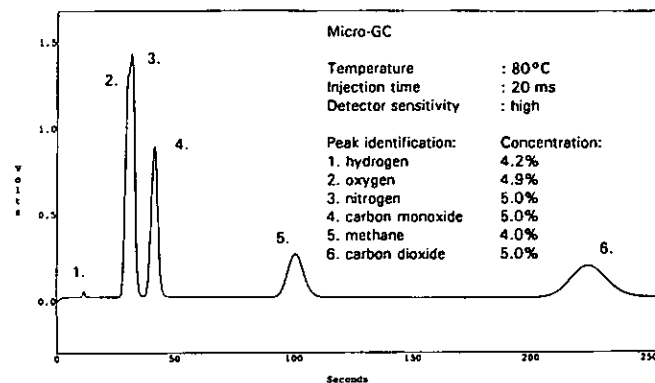
The most attractive feature, however, is that all the interfaces can be assigned and used at the same time.

The Titronic T200 is the ideal burette in the PC-controlled TPC2000 titration system from Schott-Gerate. In addition, the T200 serves as a data junction which allows other devices to be linked to the TPC2000 system controller:

Contact: Labsupply Pierce (NZ) Ltd,  
P O Box 34-234, Birkenhead, Auckland,  
Ph (09) 443 5867 Fax, (09) 444 7314.  
or circle number 40 on the reader reply card

### CO/CO<sub>2</sub> ANALYSIS WITHIN SECONDS

The Chrompack Micro-GC is a very fast gas chromatograph especially suited for the analysis of gases. Until recently, two separate column modules were necessary for the analysis of CO and CO<sub>2</sub>. A specific module for the separation of both CO and CO<sub>2</sub> is now available, leaving the second channel free for a different column module. This greatly extends the application field of the Micro-GC.



Contact:  
Alphatech Systems,  
P O Box 37-583 Parnell, Auckland,  
Tel: (09) 377 0392, Fax (09) 309 8514  
or circle number 41 on the reader reply card

### FTS SYSTEMS NEW RC 750 RECIRCULATING COOLER

#### 24KW Heat Removal

The new, RC750 Recirculating Cooler replaces tap water for a wide variety of cooling applications including cooling of lasers, exothermic chemical reactions, plastic moulding and extrusion equipment, and multiple instruments. The RC750 can remove over 24,000 watts while maintaining a constant outlet temperature of 20°C. A variety of pump options is available with flow rates up to 20gpm or pressure up to 100 psig.

Contact: John Morris Scientific Ltd,  
PO Box 6348, Wellesley Street, Auckland,  
Tel: (09) 366-3999, Fax: (09) 366-3060  
or circle number 42 on the reader reply card.

For your copy of the Waters Symmetry brochure showing how much better your chromatography can be compared to your current column contact:

Alphatech Systems, P O Box 37-583 Parnell, Auckland  
Tel: (09) 377 0392, Fax: (09) 309 8514  
or circle number 39 on the reader reply card

### THE MULTIFUNCTION TITRONIC T200 PISTON BURETTE COMMUNICATES WITH ALL THE DEVICES IN A MODERN LABORATORY:

With its own high-performance processor, the Titronic T2000 piston burette can operate both as a stand-alone unit and as an integral part of the modern Schott-Gerate titration and dosing

## METTLER TOLEDO FP900 THERMOSYSTEM:

### A new control unit for the simple and automatic determination of thermal values

Raw materials and various substances can in many cases be characterized and specified by their thermal behaviour. The METTLER TOLEDO FP900 Thermosystem is a combination of a new, powerful control and evaluation unit for use with the proven measuring cells for melting, boiling, cloud and dripping points, which combine high application versatility with conformity to standards. Operation of the system is simple thanks to the function keys and operating menu. The well devised method concept includes automated measurement and automatic evaluation and presentation of the results.

The FP90 Central Processor controls all operations. One of the five measuring cells for melting, boiling and cloud point (FP81HT Measuring Cell), for dropping and softening points (FP83HT), or for thermal microscopy and DSC (FP85) is attached to this control unit. The built-in LCD provides the operator with an overview of the ongoing measurement and the status of the control unit at all times.

The flexibility of the FP900 Thermosystem meets both the demands of the researcher and the user in routine operation. The sample is simply placed in the measuring cell, a standard method or customized measurement procedure is started by a keystroke. Immediately after attainment of the thermal value, the result is calculated and displayed. At the same time, the system cools the furnace to the start temperature with air, ready for the next sample. Depending on the measuring cell used and the evaluations selected, number results, graphs and mean values are printed. The operator guidance language and the temperature unit are configurable.



The FP90 Central Processor has an RS232C interface built in as standard for the attachment of a dot matrix printer or a computer. Attachment of an optional computer keyboard and/or a bar code reader allows simple, trouble-free entry of the sample data.

#### Contact:

Watson Victor Ltd, PO Box 1180, Wellington  
Ph: (04) 385-7699 Fax: (04) 384-4651  
or circle number 43 on the reader reply card

## A MODULAR SOLUTION TO ALL FLOW METERING APPLICATIONS

Promag is a flowmeter system for the measurement of electrically conductive liquids and is installed in free and unrestricted stretches of piping. The measuring system consists of a sensor (Promag A, D or F) and a transmitter (Promag 30 or 33) in both compact and separate versions. The system measures process flow rates and volumes in industries such as water and sewage treatment, textile manufacturing, papermaking, energy generation and the chemical industry.



Promag is a modular system to fit the specific application and has ISO 9001 quality assurance, reliability, ease-of-use, accuracy, repeatability and cost effectiveness. It operates between  $-20^{\circ}\text{C}$  and  $+60^{\circ}\text{C}$  with IP67 protection (IP 68 optional) and can be connected to all common power supplies.

Promag is available for nominal diameters 2-2000 with all standard process connections (thread, nipple, tri-clamp, hygienic, weld stub, wafer and flange) and materials (Teflon-PFA, PTFE, soft and hard rubber).

All inputs and outputs are electrically isolated from the power supply:

- \* current output 0/4-20mA
- \* pulse frequency output
- \* RS 485 port (Rackbus)
- \* zero return input
- \* SMART (HART protocol)

Promag transmitters are calibrated either with miniature switches or with the user-friendly Endress + Hauser matrix by entering application-specific and measurement parameters (e.g. relay mode, batching, display). SMART (HART protocol) technology ensures total integration into all existing and future bus systems for PLC, PCS and computer linkups.

Promag is a cost-effective modular program for measuring conductive liquids in applications requiring reliability in the most rugged industrial environments.

Contact: EMC Industrial Instrumentation  
P O Box 31-145, Milford, Auckland  
Phone: (09) 444-9229, Fax: (09) 444-1145  
or circle number 44 on the reader reply card

**ULTRASONICS WITHOUT NOISE POLLUTION  
THE NEW SOUNDPROOF TRANSSONIC T 95 HL  
FROM ELMA**

*4 x less noise than from conventional appliances*

- \* High-performance
- \* 35kHz ultrasound for cleaning tasks in chemical laboratories, in the medical field, in dental laboratories, and for degassing of HPLC solvents

Ultrasonic appliances are used in laboratories for a wide range of tasks. High performance in such fields is usually an absolute necessity. 35 or 40 kHz have proven to be the optimum frequency for appliances used for difficult cleaning jobs and degassing of HPLC solvents. The cavitation bubbles generated in such appliances may impair the working atmosphere, particularly in situations in which concentrated intellectual work is required.

The Transsonic T 95 HL represents an interesting alternative for users in such fields. The plastic housing of the appliance is soundproof and extracts water vapour from the surface of the tanks. The noise level is reduced by approximately 20dB(A). An electronic ultrasonic wave modulation is integrated for degassing of HPLC solvents and can be switched on as needed.

Contact: John Morris Scientific Ltd  
P O Box 6348, Wellesley Street, Auckland  
Tel: (09) 366-3999, Fax: (09) 366-3060  
or circle number 45 on the reader reply card

**PHOTOVAC 10S PLUS**

For two years, the National Council of the US Paper Industry for Air and Steam Improvement Inc (NCASI) undertook a laboratory and field evaluation of portable gas chromatographs for measuring reduced sulfur compounds in Kraft pulp mill workplace atmospheres.

Several portable gas chromatographs, including the Canadian manufactured Photovac 10S Plus, were evaluated and results compared against a reference HP 5790 GC. The conclusions of the evaluation by NCASI have been published in a 100-page report, No. 652, which states *inter alia* "the Photovac in general was reliable, easy to use, easy to transport and gave accurate, reproducible analyses in both laboratory and field trials".

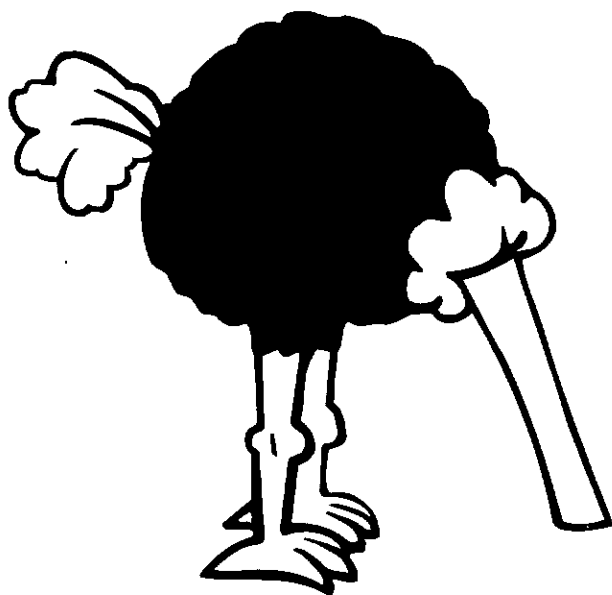
The 10S Plus has a detection limit, according to NCASI, for hydrogen sulfide of below 5 parts per billion; has a 3-point calibration capacity, and can be used for either single injection sampling or continuous, fully automatic, operation.

The NCASI President, Dr Isaiah Gellman, is quoted, in the Report's opening statement, "overall the Photovac performed best, demonstrating good precision, accuracy, portability, detection limits and calibration stability".

Further details and demonstrations of this outstanding instrument are available from:

Alltech New Zealand,  
P O Box 100-352, Auckland 10,  
Ph: (09) 444-3230, Fax: (09) 444-2399  
or circle number 46 on the reader reply card.

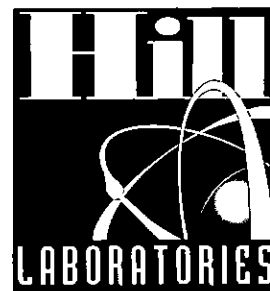
## How Do You Decide Which Contaminants To Test For In Your Environmental Samples?



Until now, you've probably not tested for as wide a range of contaminants as you would really like, because of the cost.

Hill Laboratories can now give you the peace of mind of knowing that you've had your samples tested for a wide range of chemical elements, at prices that represent a significant discount over those traditionally charged by consulting laboratories.

- Telarc-registered
- ICP-MS, GC-MS
- Organic and Inorganic
- Prompt Turnaround
- Competitive Pricing



To find out how we can help you choose the most appropriate tests for your samples, contact Dr. Peter Robinson or Dr. Terry Cooney.

R J Hill Laboratories Ltd  
(Incorporating Analytical Services Laboratory)  
25 Te Aroha St, Hamilton  
tel 07 855 2266 fax 07 854 9886

or circle number 19 on the reader reply card

**MEDTEC PRODUCTS LIMITED  
INTRODUCES NEW TEST FOR  
PETROLEUM CONTAMINATION  
IN SOIL**

Medtec Products Limited has introduced two new, easy-to-use RaPID® Systems from Ohmicron that are accurate, sensitive, faster and much less costly than traditional methods for testing for petroleum contaminants in soil.

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

One RaPID Assay System measures the volatile organic compounds (VOCs) such as benzene, toluene, ethylbenzene and xylenes (BTEX) and other small aromatic hydrocarbons in soil and water. These compounds have been identified as priority pollutants by the U.S Environmental Protection Agency.

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

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

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

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

Ohmicron Environmental Diagnostics, Inc., is a subsidiary of Ohmicron Corporation based in Newtown, Pennsylvania, which develops manufactures and markets proprietary immunoassay-based diagnostic products for the detection of contaminants in food, water and soil.

Contact: Wayne Sprosen,  
Medtec Products Limited  
P O Box 38543, Petone, Wellington  
Ph: (04) 567-0011, Fax (04)567-2821

or circle number 47 on the reader reply card

**BEILSTEIN INFORMATION SYSTEMS, INC.  
AND CAMBRIDGE SCIENTIFIC COMPUTING, INC.  
ANNOUNCE CLIENTSERVER CS CHEMOFFICE  
GATEWAY FOR CROSSFIRE**

**CS CrossFire Gateway Will Provide Users With Easy Access to the Industry's Most Prestigious Collections of Organic Compounds and Properties**

Beilstein Information Systems and Cambridge Scientific Computing, Inc. announce a partnership dedicated to the development and marketing of solutions for the needs of the research chemist and the chemical information specialist.

The first development to come out of the new association is the *CS ChemOffice 3.0 Gateway for CrossFire*. The Gateway, which will be available in the Fall of 1994, will provide unparalleled access to the Beilstein Database, the world's largest and most accurate collection of information on organic compounds. The Gateway will link RISC data servers with clients running on Macintosh computers.

This development solves the problems faced by chemists who needed to use Beilstein's critically evaluated knowledgebase, but were prevented from doing so by the lack of a cost-effective, easy-to-use solution.

Now, chemists can combine *CS ChemOffice's* ease of use and *CrossFire's* high-performance search engine to have near-instantaneous access to Beilstein's 12 gigabytes of organic chemistry information.

*CS ChemOffice™* includes *ChemDraw™*, *Chem3D™* and *ChemFinder™*, combining these three programs in a tightly integrated suite, *ChemOffice* is the one package that completely fulfills the day-to-day needs of chemists. With it, scientists do everything from preparing reports with *CS ChemDraw* to finding complex structure-activity correlations using *ChemFinder's* powerful substructure-searching features and *Chem3D's* analysis tools. *ChemOffice's* open-architecture enables scientists to extend the reach of this sophisticated desktop standard to networked servers.

Beilstein's CrossFire employs FISC technology, a new structure indexing system, and a revolutionary search engine to bring more than 6,000,000 organic compounds and associated properties in-house. Chemists, physicists, analysts, chemical engineers and students of science find in Beilstein an indispensable tool for daily research. Scientists seeking to discover relationships between structure and biological activity or compound properties have turned to Beilstein's *CrossFire* as the optimal solution.

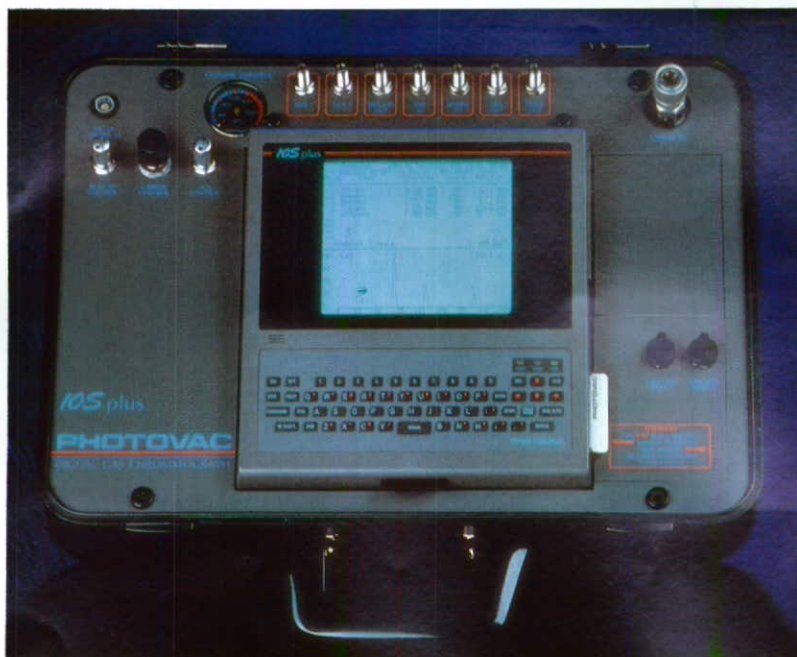
**SYSTEM REQUIREMENTS, AVAILABILITY AND PRICING**

Beilstein's *CrossFire* database management system requires and RS/6000 server. The *CS CrossFire Gateway* will be included with both *CS ChemOffice Pro*, and *ChemFinder Pro™* Macintosh. *CS ChemOffice Pro* retails for NZ\$3,595.00; *ChemFinder Pro™* retails for NZ\$1,895.00. The *CS CrossFire Gateway* will be available in the fourth quarter of 1994.

Contact: Ray Hoare, Hoare Research Software  
PO Box 4153, Hamilton East  
Ph:(07) 856-2675 Fax:(07) 856-2797

or circle number 48 on the reader reply card

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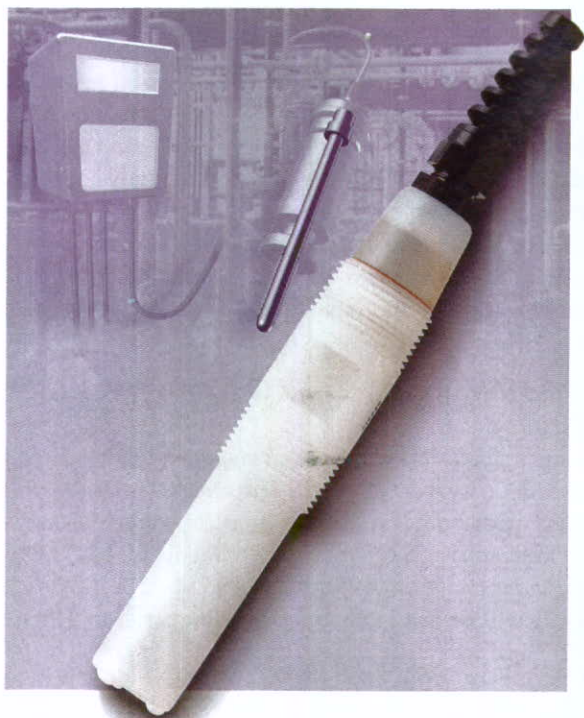
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or circle number 18 on the reader reply card

**INGOLD**  
**METTLER TOLEDO**

# New Analytical Testing Services Give Greater Peace of Mind

People who have responsibility for environmental monitoring are often faced with the problem of choosing the right balance between the peace of mind of having samples tested for *as many contaminants as possible*, versus the need to minimize expense and *stay within budget*. Budgetary constraints usually lead to a compromise situation, with some potentially-problematic contaminants not being measured ..... and peace of mind not fully achieved.

Hill Laboratories, an independent Telarc-registered consulting laboratory based in Hamilton, are using their recently-installed V.G. PlasmaQuad inductively-coupled plasma mass spectrometer (ICP-MS) to help provide clients with the peace of mind that comes from knowing that their samples have been tested for a wide range of chemical elements, at prices that represent a significant discount over what has traditionally been charged by consulting laboratories.

Laboratory charges have traditionally been directly related to the number of elements being analysed in each sample. Testing for twenty elements under this approach would be twenty times as expensive as testing for one element. The reason for this pricing is that the conventional analytical techniques employed by most consulting laboratories, such as atomic absorption spectroscopy (AAS), only permit laboratory staff to measure one element at a time. Therefore - put simply - it takes laboratories using AAS techniques twenty times as long to test for twenty elements, compared to testing for one.

## ICP-MS

The ICP-MS equipment employed by Hill Laboratories, in contrast, is able to simultaneously analyse a sample for up to 68 different chemical elements, with detection limits at least equal to and often exceeding the best that the AAS techniques can achieve.

ICP-MS involves injecting the sample (in solution) into a plasma formed by heating argon gas in an intensely powerful radio frequency field. This plasma is at around 8,000°C, which is hot enough to break down any compounds into their individual atoms. The atoms are then ionised, and pass into a mass spectrometer which sorts and measures their individual atomic masses.

## Elemental Profiles

To help their clients take full advantage of this powerful new technology, Hill Laboratories offer a variety of elemental 'profiles' for the most common types of environmental samples. These profiles greatly simplify the decisions that environmental managers need to make concerning which elements to include in their samples' analysis.

For example, Hill Laboratories provides a Timber Treatment Site profile, which analyses samples for four elements (copper, chromium, arsenic, and boron); a Leachate profile, which analyses all 17 elements of importance to landfill monitoring studies; and an Extended Ground and Surface Waters profile,

which analyses the 32 elements of most interest to those carrying out extensive investigations into environmental ground and surface waters.

## Semi-Quantitative Scan

Hill Laboratories also provides a semi-quantitative analysis screen, covering 68 different elements to an accuracy of 20% - 30%. This is especially useful for initial studies of a site when little is known about possible contamination, and the client needs to identify which elements deserve investigation in greater detail.

## Clean Room

Since the ICP-MS can detect many elements down to parts per trillion, Hill Laboratories has built a "Class 100" clean room, which is kept at a positive air pressure at all times and to which access is strictly controlled. This enables their staff to prepare sample bottles, standards, and samples without fear of contamination from the surrounding environment.

## Expansion of Organic Analysis Capabilities

Their new capabilities in inorganic chemical testing complements Hill Laboratories recent expansion into organic chemical testing. The laboratory uses gas chromatography-mass spectroscopy, and other techniques to provide analyses for a wide range of organic contaminants at equally competitive prices. Examples include both aggregate organic compounds (e.g. oils and greases, phenols, tannins), and individual organic contaminants such as solvents, hydrocarbons, PCP, PCBs, and PAHs.

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# CONFERENCES & SEMINARS

**14-15 October, 1994 Citac '94 Hong Kong Symposium on Traceability and Comparability of Analytical Measurements**

Further information can be obtained from:

Alan Turner  
General Secretary/Executive Officer NZIC  
P O Box 12-347, Wellington  
Ph (04) 473-9444  
Fax (04) 473-2324

**1-3 November, 1994 Cellular Oxidants - Production and Consequences**

Venue: Queenstown, New Zealand

A satellite meeting of the 7th Biennial Meeting of the International Society for Free Radical Research.

For further information contact:

Dr Tony Kettle (Secretary)  
Postgraduate Office  
Christchurch School of Medicine  
P O Box 4345  
Christchurch, New Zealand  
Ph (03) 364-0410  
Fax (03) 364-0451

**6-10 November, 1994 International Adhesion Symposium**

Contact: Professor H Mizumachi  
University of Tokyo  
Yayoi 1-1-1  
Bunkyo-ko, Tokyo 113  
Japan

**6-10 November, 1994 7th Biennial Scientific Meeting of the International Society for Free Radical Research**

Venue: Sydney Convention Centre, Sydney, Australia

For further information contact:

Margaret Blackwell  
IFSRR '94 Secretariat  
P O Box 77, Pymble  
NSW 2073,  
Australia  
Ph +61-2-983-9330  
Fax +61-2-983-9307

**13-17 November, 1994 3rd North American Research Conference on Organic Coatings Science and Technology**

Venue: Hilton Head, South Carolina, USA

Contact: Dr A V Patsis  
Institute for Materials Science  
SUNY, New Platz,  
NY 12561, USA  
Fax +1-914-2550978

**14-16 November, 1994 IUPAC International Symposium on Functional and High Performance Polymers**

Venue: Taipei, Taiwan

Contact: Professor Ging-Ho Hsuie  
National Tsing Hua University  
Department of Chemical Engineering

Hsinchu Taiwan 300  
Fax 886-35-726825  
Email: ipst@nthu.edu.tw

**21-25 November, 1995 New Zealand Society of Soil Science Conference**

Venue: Lincoln University, Canterbury, New Zealand

For further information contact:

Dr Alister Metherall  
Department of Soil Science  
Lincoln University  
P O Box 84,  
Canterbury  
New Zealand  
Ph (03) 325-2811  
Fax (03) 325-2944

**28 November-2 December 1994 5th SPSJ International Polymer Conference (IPC94) Society of Polymer Science**

Venue: Japan

Contact: T Takahiko  
The Society of Polymer Science  
Nagooka Building  
2-4-2 Tsukiji, Chuo-ko, Tokyo 104  
Japan  
Fax +81 3 35458560

**3-5 December, 1994 Conference of the Australasian Pharmaceutical Sciences Association**

Venue: Auckland, New Zealand

This conference will be held jointly with the Australasian Society of Clinical and Experimental Pharmacologists and Toxicologists and will include a satellite symposium on therapeutic drug monitoring.

Contact: Assoc Prof John Shaw, Conference Secretary  
APSA '94  
School of Pharmacy  
University of Otago  
P O Box 913,  
Dunedin  
New Zealand  
email reception @ gandalf.otago.ac.nz

**11-16 December, 1994 10th International Organic Agriculture Conference**

Venue: Lincoln University, Christchurch

Further information can be obtained from:

Alan Turner  
General Secretary/Executive Officer NZIC  
P O Box 12-347  
Wellington  
Ph (04) 473-9444  
Fax (04) 473-2324

**17-20 December, 1994 4th Eurasia Conference on Chemical Sciences (IV EuAs C<sub>2</sub>S)**

Venue: Federal Hotel, Kuala Lumpur, Malaysia

For further information contact:

Mr Lim Teck Thai

# CONFERENCES & SEMINARS

Conference Secretary, 4th Eurasia Conference  
c/- Institut Kimia Malaysia  
129B, Jalan Aminuddin Baki  
Taman Tun Dr Ismail  
60000 Kuala Lumpur, Malaysia  
Ph +603-7189909  
Fax +603-7189909

Contact: Mrs Klára Láng *or*  
Mr Attila Varga  
Conference Office  
Roland Eötvös Physical Society  
H-1371 Budapest, P O Box 433  
Hungary  
Ph/Fax +36-1-2018682

## 4-7 January, 1995 Inorganic Reaction Mechanisms

### **Discussion Group**

Venue: University of Newcastle, United Kingdom  
Details from Dr David Richens, University of St Andrews

## 3-8 September 1995 6th European Conference on the Spectroscopy of Biological Molecules

Venue: Université de Sciences et Technologies de Lille  
Villeneuve d'Ascq  
France

For further information contact:

Professor J C Martin (Chairman)  
ECSBM '95, LASIR, UST Lille  
Bât. C5  
59655 Villeneuve d'Ascq Cedex, France  
Ph +33-204-36988  
Fax+ 33-204-36755  
Email: ECSBM95@univ-lille1.fr +33-20434920

### **SPECIALIST GROUP MEETINGS AT MASSEY UNIVERSITY**

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

#### 1 February - 3 February, 1995 Physical Chemistry Specialist Group Meeting

A special session to honour Professor Geoff Malcolm will be held during this meeting.

NZIC members who are not in Universities should request registration forms and other information from Dr Tony Burrell (Inorganic and Organometallic Chemistry) or Dr Peter Gill (Physical Chemistry), Department of Chemistry and Biochemistry, Massey University, Private Bag 11222, Palmerston North, Ph (06) 356-9099, Fax (06) 350-5682. *University Chemistry Departments will be sent registration forms in early October.*

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

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

## 5-9 February, 1995 20th Australian Polymer Symposium

Venue: Quality Hotel, Adelaide, Australia  
For further information contact:  
Dr Mark Fisher  
SOLA International Holdings Research Centre  
P O Box 244, Morphett Vale  
SA 5162, Australia  
Fax +61-8-3261037

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

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

## 22-26 May, 1995 6th Asian Chemical Congress

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

## 17-22 December, 1995 Pacifichem '95

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

## 27 August-1 September, 1995 10th International Conference on Fourier Transform Spectroscopy

Venue: Budapest, Hungary

## 7-12 July, 1996 Organometallic Chemistry XVII

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

# PACIFICHEM '95

## 1995 INTERNATIONAL CHEMICAL CONGRESS OF PACIFIC BASIN SOCIETIES

Honolulu, Hawaii, USA ♦ December 17-22, 1995

### Call for Papers

#### Papers Sought for Pacific Basin Chemical Congress

Chemists and chemical engineers in countries bordering the Pacific Ocean and in all other countries are invited to submit papers for consideration and to attend the 1995 International Chemical Congress of Pacific Basin Societies. Scheduled for December 17-22, 1995, in Honolulu, Hawaii, it is being cosponsored by the Canadian Society for Chemistry, the American Chemical Society, the Chemical Society of Japan, the New Zealand Institute of Chemistry and the Royal Australian Chemical Institute. Chemical societies in the countries that border the Pacific Ocean will be Official Participating Organizations.

Some 4,000 reports on current research and development will be presented in about 150 symposia and in oral and poster general sessions. The Congress will also feature special scientific events, including plenary lectures, an exposition of chemically-related scientific products and services, and pre- and post-conference tours of neighbouring islands. General tours will also be offered during the Congress to places on Oahu related to the culture and history of the Hawaiian Islands that are not normally part of typical tourist activities.

Papers will be presented in symposia and in oral and poster general sessions in the 10 topical areas in which symposia are grouped on the following pages. A few symposia will be for invited papers only, but many will be for contributed papers. The basic requirements for submitting papers for consideration in oral or poster general sessions are (1) an abstract of about 150 words on the special Congress Abstract Form and (2) a long abstract of 500 to 1,000 words (plus critically important tables, graphs and figures). All contributed papers should be submitted to the Congress Secretariat.

**Abstracts must be received by March 31, 1995**

Copies of the Congress Abstract Form are now available. These and additional information on submitted papers may be obtained from the Congress Secretariat, the NZIC Office or Professor B. Halton.

Mrs C Pruitt  
Congress Secretariat  
American Chemical Society  
1155 Sixteenth, N.W.  
Washington,  
D.C. 20036, USA

The Secretary  
NZIC  
PO Box 12-347  
Wellington  
Ph: (04) 473-9444

Professor B Halton  
Chemistry Dept.  
Victoria University  
PO Box 600  
Wellington  
Ph: (04) 472-1000

## Symposium Program by Subject Area

### AREA 01 - AGROCHEMISTRY

- 006 01 New Product/Ingredient Development for Food Science
- 058 01 Free Radical Scavengers in Food and Biological Systems
- 501 01 Development of Recombinant & Wildtype Viruses for Agricultural Pest Control
- 506 01 Biotechnology of Foods and Flavours
- 520 01 Pretreatment and Hydrolysis of Lignocellulosics
- 524 01 Immunochemical Methods for Residue Analysis in Agricultural Samples: Food Safety, Environmental Quality and Worker Exposure
- 526 01 Phytochemical Pest Control Agents
- 538 01 Chemical Modification of Lignocellulosic materials
- 568 01 Process-Induced Chemical Changes in Foods
- 576 01 Structural Changes in Lignocellulosics During Pulp Production
- 620 01 Macromolecular Interactions
- 631 01 Chemical Implication of Energy Uses for Agricultural and Forestry Resources

### AREA 02 - ANALYTICAL CHEMISTRY

- 040 02 Kinetic and Mechanistic Aspects in Analytical Chemistry
- 042 02 Chemical Sensors
- 048 02 Future Directions in Electroanalytical Chemistry
- 050 02 Recent Advances in Separation Science for Biotechnology
- 051 02 Future Generations of Analytical Reagents
- 052 02 Trace and Ultratrace Analysis of Metals and Metal Complexes by HPLC and HPCE
- 055 02 Synchrotron Radiation in Analytical Chemistry
- 544 02 Lasers in Analytical Chemistry
- 561 02 Analytical and Biochemical Aspects of Seafood Safety and Nutrition
- 572 02 Solid Phases in Analytical Chemistry
- 599 02 Atomic Spectroscopy - Picogram and Beyond
- 602 02 Role of the Interface in Liquid-Liquid Separations
- 622 02 Ordered Media (Micelles, Cyclodextrins, etc.) and Analytical Chemistry: A Successful Marriage
- 623 02 Chemical Analysis with Micromachining and Miniaturized Systems

### AREA 03 - BIOSCIENCE AND TECHNOLOGY

- 510 03 Invertebrate Haemoglobins
- 025 03 Antibody Engineering
- 059 03 Advanced NMR Techniques and Biomolecular Structure
- 510 03 Invertebrate Haemoglobins
- 534 03 Altered Proteins: New Applications in Chemistry, Biochemistry, and Medicine
- 537 03 Natural Product Metabolism by Plant Cell Cultures
- 555 03 Advances in Bioprocess Engineering
- 559 03 Biosynthesis of Natural Products
- 574 03 Regulation and Metabolic Engineering of Secondary Metabolite Biosynthesis
- 587 03 Enzyme Mechanisms
- 589 03 Macromolecular Structure and Function
- 590 03 Proteins In Extreme Environments
- 591 03 Racemases and Epimerases
- 593 03 Ribozymes and Antisense Mechanism
- 596 03 Molecular Diversity Approaches in Biology and Chemistry

### AREA 04 - CHEMICAL ECONOMICS AND BUSINESS

- 562 04 The Changing Chemical Scene in the Pacific Basin
- 636 04 Technology Development and Transfer in Biotechnology within the Asian-Pacific Region

### AREA 05 - CHEMICAL EDUCATION

- 640 05 How to Reform Introductory Chemistry
- 641 05 Innovations in Teaching Chemistry
- 642 05 Progress in Computer Usage in Teaching Chemistry

**AREA 06 - ENVIRONMENTAL SCIENCE AND TECHNOLOGY**

- 002 06 Safety and Environmental Effects of Organic Metalloid Compounds  
010 06 Catalysis as Applied to Environmental Issues  
032 06 CO<sub>2</sub> Fixation and Efficient Utilization of Energy  
509 06 Biogenic Hydrocarbons in the Atmosphere  
518 06 Technology and Environmental Chemistry of Organometallics  
525 06 Environmental Applications of Ionizing Radiation: Water, Wastewater, Industrial Waste  
531 06 Environmental Biomonitoring and Specimen Banking  
532 06 Analytical Reference Materials for Environmental Science and Technology  
533 06 Protecting Drinking Water Quality and its Sources - Monitoring, Treatment and Assessment  
535 06 Phase out of CFCs: The End of One Era, The Beginning of Another  
578 06 Remediation of Chemically-Contaminated Water and Soils  
583 06 New and Emerging Environmental/Analytical Methods for Environmental Monitoring  
594 06 Formation and Control of Combustion Generated Pollution  
603 06 Volcano-Atmosphere Interactions  
633 06 Quality Assurance and Quality Control - A Dynamic Partnership of Global Dimensions  
637 06 Environmental Chemistry 1995: Problems and Prospects

**AREA 07 - INORGANIC CHEMISTRY**

- 004 07 Recent Developments in Structure, Bonding and Applications of Inorganic Fluorine Compounds  
009 07 Sulfur-Coordinated Transition Metal Complexes: Biological and Industrial Significance  
011 07 Advanced Material Design and Characterization in Microporous Space  
015 07 Polyxometalate Chemistry: Synthesis, Structure, and Reactivity  
016 07 Activation and Utilization of Small Molecules  
019 07 Metal Ions in Biology and Medicine - Natural and Synthetic Approaches  
033 07 Recent Developments in Solution Coordination Chemistry  
054 07 Electron Transfer Reactions in Bioinorganic Molecules  
505 07 Metal Complexes of Carbon: the Coordination Chemistry of Cx Ligands  
507 07 Research with Radioactive Nuclear Beams  
508 07 Advances in the Chemistry and Properties of Novel Low-Dimensional and Conducting or Superconducting Solids  
512 07 New Techniques in the Chemical Analysis of Coal  
514 07 Inorganic Photochemistry: Applications in Bioinorganic Chemistry, Energy Conversions and Catalysis  
546 07 Chemical Effects of Ultrasound  
548 07 Solid Superacids  
550 07 Applications and Advances in Main Group Element Chemistry  
558 07 Role of Spectroscopic methods in Modern Inorganic Chemistry  
563 07 New Developments and Directions in the Organometallic Chemistry of the Late Transition Metals  
584 07 Separation and Purification by Crystallization  
608 07 Geochemistry of Non-Marine Source Rocks and Petroleum  
614 07 Chemistry of Early Transition Metal/Group 15, 16 Compounds  
616 07 Chemical and Nuclear Properties of Actinides  
617 07 Environmental Radiochemistry  
618 07 Nuclear Medicine  
619 07 Nuclear Science in 2020  
621 07 Transition Metal Carbides and Nitrides: Preparation, Properties, and Catalytic Reactivity  
632 07 Environmental Geochemistry of Oxic-Anoxic Interfaces  
635 07 Chemical Terminology Involved in Materials Science: a Multidisciplinary Opportunity

**AREA 08 - MACROMOLECULAR CHEMISTRY**

- 005 08 Design of Polymers with Controlled Architecture  
007 08 Si-Based Polymers  
014 08 Multi-Electron Transfer Processes for Molecular Conversion  
024 08 Biomedical Functions and Biotechnology of Natural and Artificial Polymers  
044 08 Supramolecular Order in Polymer Colloids and Surfaces  
045 08 Polymers for Microelectronics and Photonics  
502 08 Environmental Polymer Biodegradation  
517 08 High Performance Polymers  
522 08 Kinetics and Modeling of Polymerizations  
528 08 Polymer Alloys and Blends

- 557 08 Solid State NMR: Polymer Spectroscopy and Materials Imaging  
564 08 Polymer Photophysics and Photochemistry  
569 08 Radiation Chemistry of Polymers  
581 08 Reactive Melt Processing  
607 08 Flow-Induced Structure Formation in Polymer Systems

**AREA 09 - ORGANIC CHEMISTRY**

- 001 09 Reactive and Unusual Molecules  
008 09 Biocatalysis in Organic Synthesis  
026 09 Organo-Molecular Transformation by Electrochemical Activation  
039 09 Mechanisms for Aliphatic Substitution Reactions  
043 09 Fullerenes  
503 09 Recent Advances in Organic Photochemistry  
511 09 Organometallics in Organic Transformations, Synthesis and Asymmetric Catalysis  
523 09 Phthalocyanines  
536 09 New Directions in Drug Discovery  
539 09 Molecular Recognition and Supramolecular Assemblies  
540 09 Marine and Unusual Microbial Natural Products  
543 09 New Organic Compounds: Novel Structures: Novel Properties  
545 09 Microwaves and Chemical Synthesis  
547 09 Phase-Transfer Catalysis  
552 09 Ketene Chemistry  
553 09 Fluorine in Biological Chemistry  
556 09 Organic Radical Chemistry  
566 09 Artificial Intelligence in Organic/Medicinal Chemistry  
573 09 Arachidonic Acid Metabolism in Health and Disease  
577 09 Anti-Infective Agents  
598 09 Molecular-Based Magnetic Materials  
639 09 Natural Products Chemistry and Synthesis

**AREA 10 - PHYSICAL CHEMISTRY**

- 003 10 Solvation Dynamics: From Ions to Protein  
013 10 Molecular Interaction in Solution from the Macroscopic and Thermodynamic Viewpoints  
021 10 Recent Progress in Photoelectrochemistry and Its Application to Energy, Information and Environmental Technologies  
022 10 Recent Developments in Vibrational Spectroscopy  
027 10 High-Resolution Solid-State NMR: Progress and Applications  
028 10 Chemical Applications of Synchrotron Radiation  
030 10 High Temperature and Pressure Solution Chemistry  
031 10 Frontiers of Mathematical Chemistry  
034 10 Design, Characterization and Performance of Advanced Catalytic Materials  
035 10 Low Dimensional Molecular Systems on Solid Surfaces  
036 10 Supra Molecular Assemble at Surfaces and in Solutions  
037 10 Bio-surfactants and Bio-surfaces  
038 10 Dispersed Systems and Effect of Added Polymer  
041 10 Advances in Cluster Chemistry  
046 10 Computer-aided Prediction Techniques in Chemistry  
504 10 Small Particles in Organized Media  
516 10 Structure, Dynamics, and Control of Excited States  
521 10 Electron Spectroscopy and STM/AFM Analysis of the Solid-Liquid Electrochemical Interface  
529 10 Computational Quantum Chemistry: A Viable Partner to Experiment in Chemical Research  
530 10 Excited State Molecular Association  
606 10 Advances in Quantum Monte Carlo

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# ROYAL SOCIETY OF CHEMISTRY

## RESEARCH AND TRAVEL GRANTS AND FUNDS

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### **The Corday-Morgan Memorial Fund**

The RSC Corday-Morgan Memorial Fund exists to assist members of any established Chemical Society/Institute in the Commonwealth to visit chemical establishments in another Commonwealth country. The intention is to help applicants to make stop-overs in or diversions to such countries while travelling for other purposes. It is hoped that lectures and other forms of information exchange will be given during a visit. There is no restriction on age but the visits must clearly be of benefit to the country concerned. Support will not be given for attendance at conferences.

The grants will complement, where appropriate, those for visits to developing countries available from the International Committee's fund, and funding would cover or contribute to the additional travel costs involved, together with appropriate subsistence.

The maximum award to any individual is normally £500 and persons eligible must be citizens of, and domiciled in, any Commonwealth country. Applicants must be travelling to another country (not necessarily in the Commonwealth) and would normally stop en route to visit the stop-over country, which must be in the Commonwealth.

Applications should be submitted on the official form and will normally be considered within one month of receipt.

An application form for support from the fund is available on request from the Corday-Morgan Memorial Fund c/o the International Affairs Officer, The Royal Society of Chemistry, Burlington House, Piccadilly, London W1V 0BN, England.

### **Visits to Developing Countries**

The Society, through its International Committee, has established a scheme of awards to enable members of The Royal Society of Chemistry to visit chemical establishments in developing countries. The visits must clearly be of benefit to the country concerned and the visitor would be expected to give lectures and engage in other forms of information exchange or, for example, to explore the possibility for future collaboration in research. Support will not be given for attendance at conferences. The grants will complement, where appropriate, those for visits to Commonwealth countries available from the Corday-Morgan Memorial Fund.

The intention is to help applicants make stop-overs in or diversions to a developing country while travelling for other purposes. Support for travel within a developing country may be given where appropriate. Applicants must be members of the Society and the funding would cover or contribute to the

additional travel costs together with appropriate subsistence, up to a maximum of £500.

Applications forms are available from the International Committee Awards, c/o The International Affairs Officer, The Royal Society of Chemistry, Burlington House, Piccadilly, London W1V 0BN, England.

### **Research Fund 1995**

The RSC Research Fund exists to assist members in their research by the provision of grants of up to £1000, for example for the purchase of chemicals, equipment or for running expenses of chemical education research.

If you work in a university, polytechnic, college or school anywhere in the world and your work is held up for lack of moderate funding, the Research Fund may be able to help you. Applications from members of The Royal Society of Chemistry will be considered on merit, but account will be taken of any other source of financial aid available to applicants.

Preference will be given to those working in less well-endowed institutions and to those supporting their own research. Council is especially anxious to see inventive applications of a 'pump priming' nature and is prepared to consider applications from those working in chemical education as well as chemistry research.

Members in developing countries should note particularly that additional funds have been made available for 1995 by the Society's International Committee, to provide grants for successful applicants from such countries. Preference will be given to those able to cite collaborative research projects with institutions in countries other than their own.

Applications are limited to one per department and must be submitted through the head of that department. Application forms, together with the regulations governing the Fund, may be obtained from Mrs D Howes, The Royal Society of Chemistry, Burlington House, Piccadilly, London W1V 0BN, England. The closing date for applications is 31 October 1994, but submissions sent well in advance of this date would be much appreciated.

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# NEW ZEALAND CHEMISTRY OLYMPIAD TEAM SUCCESSFUL IN OSLO

*Robert Maclagan, Department of Chemistry, University of Canterbury, Christchurch  
and*

*Kath Fletcher, Central Hawkes Bay College, Waipukurau*

Two silver and two bronze medals were awarded to the New Zealand Team at the 26th International Chemistry Olympiad held from 3-11 July 1994 in Oslo, Norway. One hundred and fifty seven students from forty one countries competed. One hundred of the competitors received medals (nineteen gold, thirty three silver, and forty eight bronze) and a further eighteen students who had not qualified for any of these were awarded "happy face" honourable mention medals fashioned in Norwegian glass in recognition that they had obtained full marks in at least one of the theoretical or practical problems. Top student for New Zealand was Andrew To from Auckland Grammar whose score for twentieth first place was less than one percent below a gold medal. Ben Wilkinson (Palmerston North Boys High School) also gained a silver and Raghav Raman (Scots College) and Duncan McGillivray (Sacred Heart College, Auckland) received bronze medals. This was equal to our 1993 performance and again placed us about 13th in the competition.



The training group was again selected by an examination held in early November, 1993. This exam was sat by 102 students from 46 schools. Both figures are greater than in previous years. As a result of the exam offers to join the training group were made to 22 students. 5 of these were women. Unfortunately in the three New Zealand teams so far there has not been a female student and they were also definitely in the minority in Oslo (14.6% of participants, but they won 22% of the gold medals.) During first term the students undertook a correspondence training program with weekly reading assignments and assignments every 2-3 weeks. Each student was able to ask a local mentor for assistance when help was needed and some of these mentors who had more than one student ran tutorial sessions. At the end of the term the group had reduced to 16 people. These students came from Dunedin (4), Christchurch (2), Wellington (1), Palmerston North (1), Hamilton (1), Auckland (7). The training camp continues to bring together some outstanding young students. The top Bursary marks in Biology and Chemistry and the top mark in

the N.Z.E.S.T exams were obtained by members of the 1993 training group. At least half the 1993 group were offered advanced placement in Chemistry courses when they enrolled at university this year.

The training/selection camp was again held at the University of Auckland, with non-Auckland students and leaders being accommodated at International House. The burden of organising the camp was again taken up by Dr Sheila Woodgate. The lectures, tutorials and laboratory supervision were the responsibility of Dr Woodgate, the team mentors, and various Auckland Chemistry Department staff members. This year the training occupied 5 days, with the selection examination being held on the Saturday morning. The team selection was based upon the performance in the 3 hour selection examination and the performance of the students in the laboratory exercises. The final selection was very difficult with 6 other students being very close to the team cutoff mark. In addition to the team, a non-travelling reserve, Wayne Patrick (Otago Boys High School) was also nominated. In 1996, with the introduction of a 4-term year, we currently plan to hold the camp in January with a smaller group continuing to train before the final team selection.

The mentors this year, (the authors of this report), were chosen in accordance with the desire to have one experienced mentor and one new or less experienced mentor each year. The team travelled to Oslo via Amsterdam, where we stayed for 3 nights in the Y.H.A hostel. This allowed us to recover from travel, in one case, recover from food poisoning, and see something of another European country. Our team was acknowledged as having travelled the furthest to get to the Olympiad in Oslo. On the last day in Amsterdam we were conducted around Holland by rail by Steven Bakker, a leader of the Dutch Olympiad organisation. He guided us to Rotterdam and a harbour cruise there showed us why it is considered one of the busiest ports in the world. We visited a working windmill in Leiden and cycled through the countryside near the village of Castricum.

We then flew to Oslo. The organisation of the Olympiad by our Norwegian hosts was superb. All the students were housed in a student hostel a short distance from the Blindern campus of the University of Oslo, and the mentors were accommodated in a bed-and-breakfast hotel nearer to the city centre.

The official opening ceremony, at Oslo City Hall, was an impressive occasion. It is impossible to describe the feeling we experienced as we walked down a long flight of marble stairs, one team at a time, accompanied by our national anthem, into the same hall where the Nobel Peace Prize is presented..

For the mentors, the Olympiad programme is always extremely busy, it is very humbling to realise that of the forty four countries

represented (forty one competing and three observing) only six had English as their first language, yet all meetings were conducted in English. One might also think that we would have it easy when it came to producing a good English version of both the theoretical and practical examination problems and instructions. This was not so! Try writing questions using units and words which will suit the United States, the United Kingdom, New Zealand, Canada, Australia and Singapore! We finished at 2.15am the first time and managed to end at 12.30am the second time around. Some team mentors were still working at 5am when the exam was due to start at 9.00am. Both of the New Zealand mentors were rooming with Mexican leaders and the Spanish version took much longer than ours. There was also the problem of the World Cup being on at the same time, so many people were trying to see some of that in the wee small hours too! I guess it was no coincidence that the symbol chosen for the 1994 Olympiad was the buckminsterfullerene molecule with its perfect football shape.

The Olympiad examination consisted of two 2½ hour practical exams and a 5½ hour theoretical exam. After the theory examination we met up with our students again on an evening cruise on Oslo Fiord and all teams spent the following day visiting Kongsberg to the west of Oslo. A journey by train into the now disused King's Silver Mine, a visit to the mining and ski museums and to the elaborately decorated Kongsberg church were included. A personal thrill for Kath Fletcher, a church organist, was being given the chance to play the largest baroque pipe organ in Europe. Both mentors and students were also able to visit a number of museums in Bygdoy.

The closing ceremony, held in the old university was a very moving experience. We had no idea whether our students would receive medals or not, but we knew that they had all gained full marks in at least one question and would get at least honourable mentions. Our students did not know that we knew this and it was very hard to keep our elation to ourselves when no honourable mentions were read out for New Zealand. We then knew that they would all be rewarded with a medal and both mentors will openly admit to the feel of tears on cheeks as we watched and waited for them to be called.

On our return journey (lasting 38 hours) we managed to spend a few hours seeing some of the sights of Bangkok.

Future Olympiads already planned are: 12-21 July, 1995 China, 1996 Russia, 1997 Canada, 1998 Australia, and 1999 Thailand. We trust that New Zealand will be there. As part of the 1994 budget \$30,000 has been allocated by the Government for the three Olympiads - Chemistry, Mathematics and Physics, subject to matching contributions from industry and professional organisations, participants etc. News of this grant reached us as we arrived in Oslo. From 1995 we will be cooperating with the Mathematics and Physics organisation in fund raising. The first New Zealand Physics Olympiad team will compete next year in Australia.

We would like to acknowledge the assistance of the following people and organisations: Dynavac New Zealand, IChem Limited, ICI Industrial Group, Institute of Environmental Science & Research Limited, G L Bowron & Co. Ltd, John Hott Charitable Trust, Ministry of Research, Science and Technology (NZ) Ltd, Norseman Pacific, New Zealand Refining

Company, Nuplex Industries Limited, Rohm and Haas NZ Ltd, Union Chemicals Ltd. Recognition also needs to be given to Dr Sheila Woodgate for her efforts in organising the camp and the training of the Auckland students; Tim Oughton for his help with exams and tests, the various university mentors, and Alan Turner, Executive Secretary of the NZIC, The Minister of Research, Science and Technology, Hon. Simon Upton has given us continued support. The Departments of Chemistry at Auckland and Canterbury Universities have made facilities and services available to us.

\* \* \* \* \*

### 12TH AUSTRALIAN AND NEW ZEALAND INTERNATIONAL SYMPOSIUM ON THE FORENSIC SCIENCES

The 12th Australian and New Zealand International Symposium on the Forensic Sciences will be held in Auckland at the Centra Hotel on 21 to 25 November, 1994. The Symposium is biennial, the last meeting being held in Hobart in 1992.

The theme for this conference is "Present achievement, future promise". The last few years have seen advances in many fields of forensic science; it is very likely that this will continue. It therefore seems appropriate that in 1994 the forensic community gives itself the opportunity to pause and reflect on the quality and the range of the work being carried out at present, and to consider the changes in techniques, procedures and other aspects of forensic science that the future will bring.

The conference programme is centred on the Plenary speakers who open each day's proceedings, and address the conference theme with reference to their own specialist areas of interest. These are followed by parallel sessions on various topics. Topics selected for presentation and discussion include Racing Chemistry, Serology and DNA, Fires and Explosions, Fibres, Fingerprints, Substance Abuse, Blood and Breath Alcohol, Physical Evidence, Forensic Toxicology, General Technology, Law, Quality Assurance and Management, Odontology, and Firearms. Poster sessions are also scheduled in the conference.

Workshops have been organised to take advantage of the expertise assembled in Auckland. These are: DNA Interpretation with Bruce Budowle, Bruce Weir and Ian Evett; the Advanced Glass Workshop with Ian Evett; and Tyre and Shoe Impressions with William Bodziak. We also hope to hold a Workshop in Fingerprint Technology and Methodology which would be organised in conjunction with the NZ Police. The first three workshops have been organised by the Australian and New Zealand Forensic Science Society in association with ESR: Forensic.

Overseas speakers including scientists from FBI and other American laboratories, from CRSE (UK), and from European laboratories are attending. A large number of expressions of interest have been received, and the organisers have every expectation that the conference will be a success.

**Further details can be obtained from:**

Douglas Elliot  
Conference Committee  
c/o ESR: Forensic, Hampstead Road  
Mount Albert  
Private Bag 92 021, Auckland

# NZIC NEWS

## COUNCIL NEWS

The August meeting of Council was held in the Chemistry Department of the University of Canterbury. The following are highlights from that meeting.

### FINANCE

The Treasurer's Report for the year ended 30 April 1994, as published in the July 1994 issue of *Chemistry in New Zealand*, was received. The Treasurer pointed out the actual state of the finances was not as good as stated, because current accounting practice includes subscriptions in arrears. Council approved a change in accounting procedures, with the agreement of the auditors, so that the income statement will only show actual income received. Under these circumstances the actual income for the 1993/94 financial year equalled expenditure.

A request from Manawatu Branch for financial support from the Overseas Visitors Fund for a visiting speaker Professor A J Lees of University of Central Lancashire was approved.

Although our original investment in Equiticorp Holdings Ltd has been written off, we continue to receive small repayments from the Statutory Managers.

### CHEMICAL EDUCATION TRUST

The audited accounts for the Chemical Education Trust have been brought up to date and are recorded in the July 1994 issue of *Chemistry in New Zealand*.

Following a request from Mr A W Mackney, Hon FNZIC, and Dr J Rogers, Hon FNZIC, Council discussed the Chemical Education Trust in detail. It concluded there was a clear need for a re-evaluation of the function of the Trust, both in promoting chemical educational activities and in raising finance for these activities. Council has undertaken to establish these principles as terms of reference for the Trustees, and to appoint new Trustees to bring them to the full complement.

Full details will be finalised at the next meeting of Council (November Standing Committee meeting) and will be reported in *Chemistry in New Zealand* following that meeting.

### MEMBERSHIP

New members admitted are reported separately.

It is with regret that we report the deaths of the following members -

BUCHANAN	Hilaire, MNZIC, Otago Branch
HULLETT	Earnest William, Hon FNZIC, Canterbury Branch
PURCHASE	Nigel Garth, MNZIC, Wellington Branch

Student membership and how better to attract students to join

was discussed. Each Branch had a different approach from "free" membership to subsidised membership with no system proving better than others. Council decided to make no changes in current membership conditions for students but would encourage innovative ideas.

### PRIZE WINNERS & HONOURS

The following Institute Prize Winners were confirmed

Easterfield Award	Dr A D Abell, Canterbury University
SGS Prize	Dr P J Steel, Canterbury University
Chemical Education Award	Mrs L Metcalfe, Villa Maria College, Christchurch

The Shell Prize for Industrial and Applied Chemistry has yet to be awarded.

### CITATION

On the occasion of the 21st year of the Chromatography Specialist Group, Council recorded its appreciation to the two founders of this group, Peter Robinson, FNZIC, and George Zabkiewicz, FNZIC, with a citation.

### COUNCIL: 1994 - 1995

The following officers are elected members of Council.

President	Professor W A Denny (Bill)	Cancer Research Laboratory School of Medicine, University of Auckland, Private Bag 92019, AUCKLAND Ph: (09) 373-7599 * 6144 Fax: (09) 373-7502
1st Vice President	Mr N E Pritchard (Nath)	159 Hakanoa Street Huntly
2nd Vice President	Dr R S Whitney (Rob)	Coal Research Association of NZ PO Box 31-244 LOWER HUTT Ph: (04) 566-2289 Fax: (04) 566-7737 Home (04) 479-7857
Hon. Gen. Secretary	Mr A A Turner (Alan)	135 Karepa Street WELLINGTON Ph: (04) 385-7710
Hon. Treasurer	Mr D P Karl (Dennis)	7 Bamfield Place Hillsborough AUCKLAND Ph/Fax: (09) 625-6689
Immed. Past President	Prof. A G Williamson (Arthur)	C/- Chemical Engineering Dept University of Canterbury Private Bag, CHRISTCHURCH Bus: (03) 364-2140 Fax: (03) 364-2063 Home: (03) 332-6815

The following are Council Delegates appointed by Branches.

Auckland	Dr J B Metson (Jim)	Chemistry Department University of Auckland Private Bag 92019 AUCKLAND	Ph: (09) 373-7599 *8302 Fax: (09) 373-7422
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Waikato	Dr W P Judd (Paul)	47B Lily Street RAGLAN	Ph: (07) 834-8888
Manawatu:	Dr G J Shaw (John)	HortResearch Private Bag 11-030 PALMERSTON NORTH	Ph: (06) 356-8019
Wellington	Dr K R Morgan (Keith)	Industrial Research Ltd PO Box 31-310 LOWER HUTT	Ph: (04) 566-6919
Canterbury	Dr J E Gregor (Jan)	ESR PO Box 29-181 CHRISTCHURCH	Ph: (03) 351-6019 Fax: (03) 351-9923
Otago	Dr R M Carr (Mel)	Chemistry Department University of Otago P O Box 56 DUNEDIN	Ph: (03) 479-7932 Fax: (03) 479-7906

## RUTHERFORD LECTURER

Sir John Meurig Thomas, Director of the Royal Institution, UK, and formerly Professor of Physical Chemistry at Cambridge has been invited to be the next Rutherford Memorial Lecturer. He will be in New Zealand for about three weeks over the Easter 1995 period.

## NZIC Membership Update

### Fellows Admitted Recently

Auckland	PALMER, Brian Desmond RUSSELL, Douglas Keith
Waikato	NICHOLSON, Brian Kenneth
Wellington	WESTON, Roderick James

Canterbury	MARTYN, Robert John
Overseas	REED, Christopher Alan

### Members Admitted Recently

Auckland	BUTLER, Catherine Anna KILMARTIN, Paul Andrew SENIOR, Hugh Edgar John SHAW, Patricia WALDEN, Adrian Ronald WALSH, Russell Stuart
Waikato	EICHLER, Stephen John LOCK, Trevor James
Wellington	LENSINK, Cornelius
Overseas	STUBBS, Hillary Jane

### Associates Admitted Recently

Waikato	CLAY, Shaun Robert GRAVER, Ian Roy MORRIS, Bruce David RUMSBY, Andrew John STEVENSON, Gavin
Canterbury	SMAIL, Samiel Julius
Otago	DOBSON, Kevin David ELLWOOD, Michael Joseph HINKLEY, Simon Francis Robert KINGSBURY, Celia Linda

### Students Admitted Recently

Auckland	BLEAKEN, Owen LORIMER, Rachel SPONG, Rebecca ZHANG, Lian
Waikato	BONNINGTON, Lea Samone

The CV of our new President appears on page 44.

## PUBLICATIONS

Council has approved the production of a brochure/poster "Careers in Chemistry" and thank Manawatu Branch for their fine efforts. "Careers in Chemistry" is to be widely distributed.

It was noted that "*Chemistry in New Zealand*" and "*CHEM NZ*" continue to flourish.

Another publication is in preparation, tentatively called "Chemical Milestones in New Zealand's Development". A presentation was received from Denis Hogan outlining the proposed technical/historical content. Council accepted "Chemical Milestones" as an Institute project and will act as an umbrella organisation in the solicitation of donations and grants.

## CONFERENCES/MEETINGS

The Inorganic and Organometallic Chemistry Specialist Group and the Physical Chemistry Specialist Group will hold day meetings at Massey University late January/early February 1995.

"Pacifichem '95, Honolulu, December 1995 is on course and later this year two PhD students will be selected to make presentations at this conference. Financial support is coming from MoRST and NZIC.

The 1996 NZIC Conference will be hosted by Otago Branch late November/early December 1996.

## RACI LINKS

A visit was received during July from Dr Susan Cumming, Executive Director of RACI. Contact was made with Council Members and Branch Officers in three Branches with a useful exchange of views resulting. Such links will continue at the executive level. Incidentally Susan (nee Dickie) is a graduate of Auckland and Otago Universities.

## CHEMICAL OLYMPIAD 1994

This has been fully reported elsewhere, but Council noted the success of the team and approved continuing support for future Olympiads.

TORRENS, Robert Samuel  
WALKER, Lisa Dawn  
WATENE, Erina May

Manawatu ALLWOOD, Jacinda  
ANDERSON, Damaris  
BARRETT, Paul  
BISHOP, Peter  
CAMPBELL, Wayne  
CASHMORE, Fiona  
FISHER, Louisa  
FORESTER, Natasha Talei  
FORSYTH, James Allen  
KINNON, Sandra  
LILLY, Michael  
ROBERTS, L C  
ROBERTSON, Craig  
SMALES, Mark  
TAYLOR, Sue  
WU, Yinqiu

## PRESIDENT'S ANNUAL REPORT

Although from the point of view of the individual member, societies like NZIC do not appear to do a great deal in any one year, one does get a slightly different perspective as President. This is largely because one becomes involved with each of the activities of the various individual groups within the Institute.

### Publications

When I first got onto the Presidential treadmill the major concern of Council and membership was the high cost and consequent drain on the Institute, of the Journal, *Chemistry in New Zealand*.

Due largely to the efforts of Jim Metson and Robert Lyon we now have a Journal that is appearing regularly, which contains improving content and which is no longer a drain on the resources of the Institute. The Journal, now into the second year of its new life looks like continuing to even greater strength. While this is a source of satisfaction, it does not give cause for complacency and it is still important for members to support the Editorial Committee and to provide appropriate material for publication. In particular the Journal should be one means of communicating between branches.

The other major publication sponsored by the Institute, CHEM NZ is aimed at the secondary education market though I am sure that there are many avid readers of CHEM NZ who are not secondary school pupils or teachers. Under the editorship of Denis Hogan and a band of enthusiastic helpers CHEM NZ has gone from strength to strength. Its two major achievements this year have been:-

- 1) The achievement of international status with a subscription from the Education Department of the Royal Society of Chemistry as part of a bulk subscription to the Journal of Chemical Education with RSC offers to British schools. Around eight hundred and fifty copies of each issue now go to Britain.
- 2) The publication of a special discussion issue of the draft Chemistry Curriculum which brought together a great deal of fact and opinion in an attempt to clarify issues arising from the Curriculum development.

A new edition of "Chemical Processes in New Zealand" is in preparation under the guidance of Associate Professor John Packer of Auckland University. Professor Packer expects to follow the procedure used in the past involving industrial and academic partners in the production of each process description.

A brochure "Careers in Chemistry" is being prepared by a team in Manawatu Branch under Mike Boland. This is shortly to be published with assistance from the NZ Chemical Industry Council.

In the editorial field the Chemical Education subcommittee put in a great deal of work in examining the draft Chemistry Curriculum and I am sure that the Institute's submission on this matter will contribute to a useful outcome of the Curriculum reforms.

The Science Policy and Public Affairs Committee made a submission to the Victoria University of Wellington Review Panel on the Chemistry Department.

### Olympiad

As you will know from previous reports, New Zealand now takes part in the International Chemical Olympiads having sent teams to Italy and the USA respectively in 1993 and 1992. This year the meeting was Oslo and the New Zealand team gained two silver and two bronze medals repeating the success of 1993. As with many of our enterprises the success of the Olympiad participation depends heavily on the enthusiasm, dedication and hard work of a small group of whom Robert Maclagan, Sheila Woodgate, Cath Fletcher and Tim Oughton have been particularly heavily involved. The impact of Olympiad activity is of course not limited to those who attend the finals but extends through those involved in the training camps and back to all students and teachers who take part in the preliminaries. It must be pleasing to all those involved to see the success of the representatives who go to the Olympiad. This is a measure of the quality of both our students and of our teachers of Chemistry. Of further satisfaction to the Institute is the recognition that these efforts have received in the form of a contribution of \$30,000 from the Ministry of Research, Science and Technology towards the next round of Olympiads in Maths, Physics and Chemistry.

### Conferences

The 1993 Conference in Auckland was highly successful with an excellent range of visiting speakers and very good attendance of New Zealand chemists and a good financial return to the Institute. While there is no general conference planned for 1994 there will be specialist group meetings in 1995 and it is hoped that there will be a significant New Zealand presence at the Pacificchem '95, details of which have been and will be published in the *Chemistry in New Zealand*.

### RACI

Relations with the Royal Australian Chemical Institute continue to develop with the participation of the RACI President in the Conference last December and a visit from the RACI Chief Executive in July 1994. Regular exchanges of information now take place between the two executive officers and it is hoped that there will be strengthening of interactions at the specialist group levels. For the moment I

believe that while there are advantages to both Institutes in developing closer relations there is no advantage to either in amalgamation.

### Membership

The branches appear to be in good heart and active in promoting the interests of chemists in their areas. Membership is stable around 1400 made up as follows;

Hon Fellows	35
Fellows	321
Members	731
Associates	148
Students	162

However there is a need to bring more young chemists into the Institute. In particular I would suggest that we should make greater effort to attract student members.

I wish to thank the Council members, delegates and branch committees for their work during the year. I also wish to thank the Executive Officer, Alan Turner for keeping me on the straight and narrow path during my term of office.

*Arthur Williamson*

## NEW PRESIDENT

### WILLIAM ALEXANDER DENNY

#### Address

Cancer Research Laboratory, University of Auckland, Private Bag 92019, Auckland, New Zealand. Phone 64-9-3737-599, Fax 64-9-3737-502. Email wa.denny@auckland.ac.nz. Private phone 64-9-5769-595.

#### Education

Patumahoe and Paerata Primary schools, Te Awamutu College, University of Auckland (BSc, MSc [1st class], PhD, DSc).

#### Current positions

- Co-Director, Cancer Research Laboratory, University of Auckland School of Medicine.
- Adjunct Professor, Department of Chemistry, University of Auckland.

#### Professional Society memberships

- NZ Institute of Chemistry (Member, 1973; Fellow, 1981; President 1994-1995).
- NZ Society for Oncology (Member, 1974; Vice President, 1993-1994).
- American Chemical Society (Member, 1982).
- Royal Society of NZ [NZ Academy of Science] (Member 1973; Fellow, 1988; Member of Council 1992-1993).

#### Other science-related activities

- Member, IUPAC Medicinal Chemistry Committee.
- Member, International Editorial Advisory Committee, Anti-Cancer Drug Design.
- Member, International Editorial Board, Heterocyclic Communications.
- Reviewer for: Health Research Council of NZ, Cancer Society of NZ, NZ Lottery Board Medical Research Committee, Australian National Health & Medical Research Council, Australian Research Council, Anti-Cancer Council of Victoria, New South Wales Anti-Cancer Council.

### Specific research achievements


- Development of amsacrine, the first laboratory-designed DNA-intercalating agent to successfully enter clinical use (in 1978).
- Following extensive quantitative structure-activity studies of amsacrine analogues, development of the amsacrine analogue CI-921, designed specifically to maximize physicochemical properties thought to be important for broader-spectrum activity, and currently in Phase II trials in the UK.
- The concept of "minimal" DNA-intercalating agents, aimed at maximizing drug distributive properties, which resulted in the development of DACA (NSC 601136), currently in clinical trials in the UK and NZ.
- Discovery of the xanthononeacetic acids, a class of potent immune stimulants; one member of this class (DMXAA) is scheduled for clinical trial in the UK in 1995.
- Theoretical and practical demonstration of the concepts of deactivated alkylators, cobalt mustards and nitrobenzyl quaternary mustards as novel classes of hypoxia-selective drugs.
- Development of the concept of bis-bioreductive agents as hypoxia-selective cytotoxins of enhanced hypoxic selectivity.
- Demonstration of the first DNA tris-intercalating and contiguous-binding DNA bis-intercalating agents.
- Discovery of several new classes of potent inhibitors of the tyrosine kinase functions of key enzymes in the signal transduction pathways in cells.

### Current research interests

The design and development of new classes of anticancer drugs with selectivity for solid tumours. These include inhibitors of the tyrosine kinase function of enzymes in the signal transduction pathway, hypoxia-selective drugs, and gene-selective DNA alkylating agents.

### Publications

To date, 276 papers published or accepted for publication in primary refereed journals, a further 12 papers submitted, and 22 patents filed and published.

  
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## Manawatu

The Dead Chemists' Society met for their annual mid-winter feast and quiz on 11 July. Amongst the notables attending were Ernest Rutherford (Harold Percival) meeting members of his new branch and Gay Loo Sack (Stan White) winner of the best costume award. Everybody enjoyed themselves even though the quiz stumped a few.

*A copy of the quiz is included below and the answers will be in the next issue of Chemistry in New Zealand. Keen competitors can send their answers to...*

Grant Boston

Milkfat Products Section

New Zealand Dairy Research Institute

Private Bag 11 029

Palmerston North

New Zealand...

*before 5 October. If we can prise the cheque book from Alan Furness' hands, prizes may be awarded!*

The next meeting of the branch will be a visit to the Palmerston North City Council facilities in September.

Simon Brown has recently joined the Department of Chemistry and Biochemistry at Massey. Simon graduated from ANU in 1988 and has studied at Oxford University (1988-90) and Glynn Research Institute (1990-94). His research is aimed at understanding the energy transducing processes common to all cells. He is particularly interested in the molecular mechanisms and structures of the protein complexes which catalyse the electron transfer reaction of respiration and photosynthesis.

The committee has been busy over the winter months and has produced a new careers brochure and poster for use by all branches. It will be launched at the 1994 Careers Expo on 18 September. Our regular participation in these Expos has promoted chemistry as a career and has been well received, the new brochure will help set students on the right track to a career in chemistry. Copies should be generally available by the end of September. Contact the General Secretary, Alan Turner if your branch would like some.

The annual Manawatu Chemistry Quiz was more popular this year. 1082 pupils from 27 schools in our region participated and 714 certificates were awarded. Top marks of 29/30 in the Junior Quiz went to Alastair Hume (Central Hawkes Bay College), Grant Pedersen (Napier Boys High School), and Cameron Anderson (Wanganui Collegiate). Top marks of 27/30 in the Senior Quiz went to Rhys Nicholls (Fielding Agriculture High School), Shamus Husheer (Taradale High School), and Stephen Hoskin (Tararua College).

\* \* \* \* \*

## Section 1: (3 pts each)

1. Others, such as Newland, had noticed periodicity in the elements. Mendeleev not only put up a model for the periodic table, he also predicted the existence of three new elements from gaps in his table. He predicted elements 'eka boron, eka aluminium and eka silicon'. What were they (in order)?

2. He may have been the first to discover oxygen, using Priestly's method two years earlier. He also discovered hydrofluoric, nitrosulphonic, molybdic, tungstic and arsenic acids, as well as lactic, gallic, pyrogallic, oxalic, citric, tartaric, malic and uric. Also he demonstrated that graphite is a form of carbon. Who was he and what is the major discovery he is chiefly remembered for?

3. Following the fall of Greece and Rome, it was the Arabs that carried on and developed the culture of those civilisations up until the time of Thomas Aquinas. During this time, progress in science was made, particularly by Arabian alchemists. The greatest of the Arabian alchemists lived around 750 AD. Probably his most important discovery was acetic acid which was the first known substance to cause chemical change without heating. The name of the alchemist occurs as a derogatory term in the English language. Who was he?

4. Cobalt was discovered in 1737 by the Swedish chemist Brandt, and was the first new metal not known to the ancient world. Nickel was discovered fourteen years later in 1751 by Cronstedt, another Swede and a student of Brandt. These elements were prepared from copper ores that would not yield copper. Where did the names of Nickel and Cobalt come from?

5. We all know about Rutherford, but there is another NZ-born Nobel Laureate in Medicine and Physiology who was a chemist. Who was he, who were his co-Laureates, and which NZ branch of the NZIC does his birthplace come under?

## Section 2: (3 pts each)

Elementary Chemistry:

1. In 1794, the Finnish chemist Johan Gadolin discovered a new type of mineral he called "rare earth". This opened the way for the discovery of the Lanthanide series of elements by Mosander and others. What do the Lanthanide elements with atomic numbers of 65, 68 and 70 have in common with element 39? Where is it?

2. There are two elements which have, in elemental form, a density at 20°C of greater than 22. What are they? Also name the two elements that sit immediately above them in the periodic table. Put a circle around the latter two answers.

3. Harold Urey discovered this atomic species and was awarded the Nobel prize for it in 1934. What is it? Put a circle around this answer.

4. This group VI element was isolated from a naturally occurring compound with gold. Work on it has been unpopular because of the bad smell that many of its compounds have.

Put a circle around this answer.

5. One country has had not just one, but two elements named after it. One of these was only discovered in the late 1930's and filled one of the last gaps in the periodic table. What is it? Put a circle around this answer.

6. What is "dephlogisticated air". Put a circle around this answer. (O)

**Section 3:** (3 pts each)

1. Name branch chairperson, secretary and treasurer.
2. Name, in chronological order, the past five branch chairpersons.
3. Name, in chronological order, the last five Institute Presidents.
4. Name three past or present Manawatu Branch members who have been Institute Presidents.
6. Name five specialist groups of the NZIC (excluding sub branches)

**Bonus Section:**

All the above circled answers, if written as symbols, form an anagram. Solve the anagram, and give the atomic number of the element indirectly referred to. (10 pts)

# BOOK REVIEW

## PRINCIPLES OF NUCLEAR MAGNETIC RESONANCE MICROSCOPY

**Paul T Callaghan**  
Clarendon Press, Oxford, 1991  
paperback NZ\$99.95, 492pp

The use of nuclear magnetic resonance imaging (MRI) for whole-body scanning has become widespread since its inception in 1973. In 1986 several researchers reported applications of MRI at small scales but high spatial resolution, using standard NMR spectrometers with added facilities for production of magnetic field gradients. This equipment is now commercially available and widely used. The signal is acquired in the presence of a magnetic field gradient (**k**-space acquisition.) It's resolution is not as good as optical microscopy, however, it is a non-invasive technique with a range of contrasts available using the full range of conventional NMR spectroscopy parameters such as chemical shifts and spin relaxation times. In addition the pulsed gradient spin echo experiment (**q**-space imaging) enables molecular motions and morphology in porous systems to be studied, and may achieve spatial resolution two orders of magnitude better than **k**-space imaging. The author of this book, who is professor of Physics at Massey University, was one of the pioneers in this field and has developed an international reputation.

There are many potential applications of imaging in biology, studying molecular dynamics, and heterogeneous phases and systems in shear. There are applications in industries such as petrochemicals, polymers, biotechnology, food and natural products processing.

This is not really a book for glancing through to see what NMR microscopy could do for you, though it does include a number of interesting, non-medical applications, some illustrated with colour plates, that demonstrate the wide variety of techniques and applications available. Rather the text is aimed at graduate researchers (with a fair knowledge of mathematics), though a knowledge of NMR is not essential as the principles required are covered in useful introductory chapters. The underlying principles governing NMR microscopy - the effects of magnetic field gradients, **k**-space and **q**-space imaging are very thoroughly covered and instrumentation is touched on briefly (as it is now commercially available.) This is a comprehensive account of the theory and practice of NMR microscopy, well illustrated with interesting applications, and likely to become a standard text for those wishing to use the technique. It is perhaps a little too comprehensive for those wishing to obtain a quick overview of the applications of NMR microscopy.

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Reviewed by: R. Meinhold

# New Literature and Media

## International Newsletter on Chemical Education

No. 41, June 1994

This issue is devoted to Chemistry and Distance Learning. Contents comprise:

"Other ways to learn - and to teach - chemistry"

R. R. Hill, Department of Chemistry, The Open University Milton Keynes, United Kingdom.

"New learning opportunities at a distance ... and on campus"

Y. Y. Ashmore and P. G. Taylor, Department of Chemistry, The Open University, Milton Keynes, United Kingdom.

"Using and developing media"

P. A. Kirchner, Educational Development Innovation Centre OTIC and M. A. M. Meester, Department of Natural Sciences, Open University of the Netherlands.

"Experimental work and distance learning"

S. W. Bennett, Department of Chemistry, The Open University, Milton Keynes, United Kingdom.

"Chemists must write"

R. R. Hill, Department of Chemistry, Milton Keynes, United Kingdom.

"Developing systems, producing materials, running programs"

H. Morgan, Department of Science, The Correspondence School, Wellington, New Zealand.

"The IUPAC-CTC and distance learning"

K. V. Sane, Department of Chemistry, University of Delhi, Delhi, India.

Details are available from:

the Editor, *Chemistry in New Zealand*.

## New Databases on STN International

STN International has expanded its coverage of pharmaceutical and biomedical information by adding a number of databases to its wide range of scientific and technical databases. The newcomers include MRCK (drugs, chemicals), DRUGUPDATES (pharmaceutical development), DRUGNL (pharmaceutical news), DRUGLAUNCH (new pharmaceutical products), IPA (pharmacy), TOXLINE and TOXLIT (toxicology, drugs, chemicals), and AIDSLINE (scientific literature related to Acquired Immunodeficiency Syndrome).

The MRCK database, an updated and expanded on-line version of The Merck Index, Eleventh Edition contains concise descriptions of human and veterinary drugs, biological and natural products, agricultural chemicals, organic and inorganic chemicals used in commerce and research, as well as other environmentally significant compounds. Records contain substance, toxicity, and property data, therapeutic and

commercial uses, and source information. MRCK is also a valuable source of synonyms and trade names which can be selected as chemical names to search in other STN databases. In addition, MRCK includes information not yet available in print. Produced by Merck & Co., Inc., the database contains more than 10,000 records.

Information on the latest developments in the worldwide pharmaceutical industry is available in two databases - DRUGUPDATES and DRUGNL. DRUGUPDATES monitors all phases of drug development, from earliest laboratory and patent reports, through preclinical and clinical trials to actual market launch. Information in this database can aid users in answering questions such as Which antibiotics are approaching worldwide launch?; Who has licensed drugs for development?; and Which drugs are being developed? The database contains 5,900 records. DRUGNL is the full-text of R7D Focus Drug News which contains information on new developments in pharmaceutical companies and health care institutions around the world. In addition to the full text of reports, the 3,900 records in DRUGNL also include chemical names, company names, source information, and CAS Registry Numbers. Both databases are produced by IMSWORLD Publications, Ltd, UK.

Also produced by IMSWORLD Publications is DRUGLAUNCH, a database providing information on the introduction of new pharmaceutical products in 57 countries. Updated monthly with about 600 records, DRUGLAUNCH draws from journals, magazines, newsletters, and the more than 50 IMSWORLD offices that collect data on new pharmaceutical products. DRUGLAUNCH contains over 55,000 records.

The IPA (International Pharmaceutical Abstracts) database includes not only clinical and technical drug information but also topics relating to the practice of pharmacy, pharmaceutical information and legal aspects of pharmacies and drugs. Produced by the American Society of Hospital Pharmacists, IPA contains more than 250,000 records, dating from 1970 to the present and covers approximately 800 international pharmacy, biomedical and cosmetic journals. With the addition of IPA, STN now offers nearly 30 databases covering pharmaceutical information, including the Derwent Drug File and Derwent Drug Registry File loaded on STN on 4 July this year.

The TOXLINE (Toxicity Literature Online) and TOXLIT (Toxicology Literature from Special Sources) databases provide access to literature on the pharmacological, biochemical, physiological, and toxicological effects of drugs and other chemicals. TOXLINE contains 1.9 million records with references and abstracts on drug testing and interaction, food contamination, environmental pollution, occupational hazards, and regulatory issues drawn from a variety of governmental and non-governmental sources. TOXLIT contains 1.9 million records with references on similar topics drawn from the CA database. TOXLINE and TOXLIT join the family of over 40 other databases on STN that cover environmental, toxicological, and health and safety topics.

AIDSLINE is the latest addition to STN International's collection of biomedical databases. Produced by the U.S. National Library of Medicine, the database contains citations

to and abstracts of literature on clinical aspects, health issues, and research related to AIDS (Acquired Immunodeficiency Syndrome). AIDSLINE provides valuable information for biomedical scientists - pharmacologist, clinicians, biochemists, pathologists, and physicians - along with information professionals. It covers biomedical, epidemiologic, oncologic and social and behavioural sciences aspects of AIDS literature. Updated monthly with about 1,000 records, AIDSLINE brings together information on more than 95,000 documents from 1980 to date drawn from journals, conference and meeting proceedings, books, monographs, and theses.

STN International, the Scientific and Technical Information Network, is jointly operated by FIZ Karlsruhe in Europe, Chemical Abstracts Service (CAS), Columbus, Ohio, in North America, and by JICST, the Japan Information Center of Science and Technology in Japan. A network of over 180 databases, STN International offers information on a broad range of scientific fields.

For further information, please contact STN International, c/o FIZ Karlsruhe, P O Box 2465, D-76012 Karlsruhe, Germany; Tel.: (+49) 7247/808-555; Fax: (+49) 7247/808-259; or via electronic mailbox STNmail (ID: HLPDESKK).

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## ADVERTISERS INDEX

ADVANTAGE DATA SYSTEMS	Outside Back Cover
ALLTECH ASSOCIATES INC	32
ANCAT HOLDINGS LTD	33
BALDWIN, SON & CAREY	46
BIO-RAD LABORATORIES PTY LTD	17
DOUGLAS SCIENTIFIC	Front Cover, 2
GBC SCIENTIFIC (NZ)	3
INDUSTRIAL RESEARCH LTD	19
JOHN MORRIS SCIENTIFIC LTD	32
LABSPEC	33
LABSUPPLY PIERCE NZ LTD	Inside Back Cover
MINISTRY OF AGRICULTURE & FISHERIES	
Chemical Residues Lab, Wallaceville	6
PERKIN ELMER PTY LTD	Inside Front Cover
R J HILL LABORATORIES	30
SCI TECH	10
SGS NZ LTD	44

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