chemistry

in new zealand

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Front Cover Story

The Mistral 3000 is a totally new concept in bench-top refrigerated centrifugation. It is microprocessor controlled and offers a full three litre capacity with its main 4 x 750 ml windshielded swing-out rotor, which accommodates a wide range of sealed containers and colour coded adaptors.

Alternatively, the 8 x 200 ml swing-out rotor accepts all the adaptors from the existing Centaur 2 accessory range.

GUEST EDITORIAL

National Need For Increased Research and Development

The need for maximum effort in research and development by individuals, companies and the government has never been greater than at the present time.

Because New Zealand is embarking upon a new trading era which will require it to use all its resources, but most of all those of its human resource. The need for incentives and opportunities for innovation, research, development and entrepreneurial activities has never been greater.

Recent Treasury commentators have taken the view that these activities are best undertaken by those closest to the market place. i.e. the private sector or those government trading departments heavily involved in new technologies or new developments. These attitudes have been reverberating through several government departments and challenge our existing research and development infrastructure.

The questions of how best New Zealand should focus its relatively small, yet expensive research and development resources leads one to the following basic principles:

1. **Pure and applied science and technology should be closely linked both physically and psychologically and closely associated with seats of learning for centres of excellence in particular topic areas.**

The most outstanding successes illustrated in this principle are the dozens of science parks in North America and the company technical institutes with construction companies of Japanese heavy industry or electronic conglomerants. Physically isolating Universities, research establishments and similar innovative centres from the sectors they serve is wrong and is counter-productive.

2. **Only effective research should be undertaken in New Zealand. (i.e. that in which there is likely to be payback to the country).**

Effective research is that in which there is a payback to the investor. Researchers must be accountable, not only to their peers, but also to those who have invested in them.

3. **All research that is undertaken in New Zealand should be market orientated.**

The term "market" as well as "commercial markets", recognising the needs of government departments such as police (for example forensic research) or justice (social behaviours) or "marketing research" (e.g. offshore market needs).

4. **The management of Research and Development activities must be completely decentralised but kept as close as possible to its market.**

From a Government's point of view the question is how should innovation research, development and entrepreneurial activities be encouraged and managed. It follows if these are to be accountable functions then they should be managed using the same principles as any other accountable function. This means that the decisions on what is done, what resources are to be committed, when to start and stop etc, should be done as close to the researchers involved and to their market. In other words research and development must be monitored closely by the market which will

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COMMENT FROM THE HOUSE

We have recently received details from Mr Simon Upton, M.P. and Opposition Spokesperson on Science and Technology, on points raised by him during the debate on the Science Estimate, 1985. Space does not permit us to reproduce the full text of Mr Upton's notes, but the key points are as follows:

- The Government is seeking to cut its spending on research and development in both gross and net terms.
- By 1987/88 the DSIR Budget will have shrunk from $120 million to $111 million, and the Government's contribution will be down from $106 million to $84 million.
- At the same time Government expects industry to fund by way of charges, nearly one third of all DSIR research.
- The commercialisation of research is widely predicted to lead to a collapse in long-term, strategic research.
- Despite concern within NRAC, recommendations from the Science and Technology Conference and the Probine Committee Report of 1984, the Government has failed to restructure the key policy making and advisory bodies in the science arena.
- The result is a policy vacuum with confused lines of communication between researchers, industry and government.
- DSIR is facing a rapid deterioration in its ability to retain key staff. It is now losing in excess of 23 staff each month.
- Shortages are caused at least in part by inadequate salary levels and the mechanism whereby they are set.
- The commercialisation of DSIR and the reduction in long-term research is contributing to the loss of staff with extremely sought-after skills.
- Government contributions to the three key research associations which service New Zealand's pastoral industries continue to fall behind. At the very moment when those industries desperately need to seek out long-term solutions, strategic research is falling away.
- Despite holding a large (and costly) Science & Technology Conference, and probably having more advice on science and technology than any previous government, no new policy initiatives have been taken by the Government.
- The Government has failed even to produce a policy position in respect to financial incentives for research and development.
- The educational base for scientific research is clearly being neglected. Our universities in this regard have been described as looking "more and more like an advanced college or polytech."
- At a time when the Government is removing exams from the school system, the NRAC is making a plea for basic numeracy skills.
- A declining number of secondary school students are studying physics and chemistry with alarming implications for scientific and technical skills in the future.
- No initiatives have yet been taken to integrate New Zealand's education system into a coherent, national science strategy despite repeated calls, most recently at the Science & Technology Conference.

"With a crisis of confidence looming in the science and research arena, one can only agree with the conclusions of 'Nature' magazine which stated;

> "No powerful voice represents science to a high level of government. But without giving science high priority, how can the technological change on which New Zealand has set is mark ever be achieved."

Clearly, science's man at the cabinet table — Mr Tizard — has been beaten by the Treasury ministers. Mr Tizard has been a public critic of Treasury since being a Minister in this government — he clearly disagrees with the philosophy he is being forced to implement. The honourable thing to do would be to resign rather than preside over a slow, depressing decline in New Zealand's research capabilities.

This Government has been offered more advice on science policy than any previous administration. It is conspicuous for having achieved less for science than any of its predecessors."

NOTICES

CHEMICAL EDUCATION QUESTIONNAIRE

Last month members should have all received a copy of a questionnaire from the Chemical Education Committee of the NZIC. In the words of the convenor, Graeme Valpy, this was intended to achieve several things:

> "Firstly we hope to awaken the interest of chemists in all aspects of Chemical Education, and indeed Science Education. Secondly we need to know what range of opinions chemists hold about the resources appropriate to the teaching of Chemistry whether at Primary, Intermediate, or Secondary school and the place of experimental or laboratory work in that context. It may be that we achieve no more than publicity for the fact that there is a Chemical Education Committee of NZIC, and that it hopes to stimulate a discussion over issues which are acknowledged to be vital to Chemistry, and Science generally. Even that would be of considerable value but we look to those who teach Chemistry to acquaint us with their concerns, and to notify us of their professional attitude towards promoting any changes which could allow realistic policy changes in those areas which the Institute could properly influence."

Note that the committee hopes to receive a reply from all members, not just those directly involved in teaching. If you haven't sent in a return yet, please do so. If you didn't receive a questionnaire, please contact your Branch Secretary.

ROYAL SOCIETY OF CHEMISTRY'S NEW SECRETARY GENERAL

The new Secretary General of the Royal Society of Chemistry is Dr John Stobie Gow, CChem FRSC, FRSE, currently Managing Director (UK), ICI Specialty Chemicals. Dr Gow becomes Secretary General Designate on 1 January 1986, and assumes full responsibility on 13 January 1986.

Letter To The Editor

DESIGN FOR THE DAY AFTER — DOWN UNDER

In April, the Royal Society of New Zealand produced a report on the consequences to New Zealand of a nuclear war. It was not the first such attempt, and the useful collection of data was marred by the lack of any rational conclusion, but at least our parent body deserves credit for thinking the issue important and making the effort. A few other scattered voices have been attempting to dispel the majority view that we would not survive. All the evidence says otherwise. Both New Zealand and Australia would survive, and reasonably well. Yet neither country has made any preparations whatever. They now spend a dollar and 40c respectively per head on civil defence each year.

Some push for political action is needed from scientists who are better able than the public to appreciate a nuclear winter and fall-out.

Social issues would claim immediate priority in a contingency plan, but in the longer term, sector-by-sector planning for a trans-Tasman economy would be essential. In this, professional groups such as engineers and chemists would have a vital role.

How would we fare, chemically that is, for liquid fuels, plastics, coatings, adhesives, solvents, rubber, basic drugs and agricultural chemicals? Even chemists would, in the event, be surprised at our dependence on chemistry. The classic exam question: "Starting from coke and limestone how would you synthesise...?" would take on a new significance!

I suggest, quite seriously, that "Chemical Industry in New Zealand After a Nuclear War" should be the subject of a session at the next annual conference. The Institute might set up a study group in conjunction with the newly formed Chemical Industry Council on the topic. One way or another the Institute should act towards stimulating New Zealand to shoulder a responsibility, now a matter of culpable neglect by our government. Only an optimist could deny, looking at the Strategic Defence Initiative of the Reagan administration, that the risk is real and growing.

In the meantime I would be interested to hear from any like minds within the Institute.

R. H. Locker
110 Hillcrest Road,
Hamilton.

1987 ANZAAS

Preliminary details have recently been announced for the 56th ANZAAS Congress, to be held in Palmerston North, January 1987. Congress Chairman is **Prof. Keith W. Thomson,** and the Organising Secretary, **Dr Michael Baxter,** both of Massey University, Palmerston North, New Zealand. The theme of the Congress is Science in a Changing Society. In keeping with this, part of the programme is to be based in the City Centre with interdisciplinary symposia on themes such as science and its role in the community, and the new technology — implications for society. Sectional programmes will be held on the university campus, and organised around various subject groupings, including physical and mathematical sciences, technological and biochemical sciences, biological sciences, health sciences and environmental sciences.

THE USE OF CLEAN LABORATORIES IN TRACE ELEMENT ANALYSIS

W. W. Ahlers and K. A. Hunter, Chemistry Department, University of Otago, Dunedin.

W. W. (Bill) Ahlers

Bill Ahlers graduated MSc in Chemistry from the University of Auckland in 1982 and subsequently came to the Chemistry Department, University of Otago. There he is currently working as a Scientific Officer on a study of water quality and trace element chemistry in the catchment of the Hawkdun lignite field (a study sponsored by NZERDC). He is also concurrently working on his PhD thesis in trace element geochemistry in subalpine freshwaters. Bill is interested in ornithology, alpine plants and tramping. He is a committed environmentalist and is particularly active in the preservation of native forests, tussock grasslands and coastal habitats.

Keith A. Hunter

Keith Hunter graduated MSc in Chemistry from the University of Auckland in 1973, subsequently studying for PhD with Dr Peter S. Liss at the University of East Anglia. After a period of postdoctoral research in France and the U.K. he was appointed to the Chemistry Department, University of Otago in 1979 where he is now a senior lecturer. His research interests involve the marine geochemistry of trace elements and the chemistry of colloids and surfaces in natural waters. Outside activities include teaching swimming, eating and cooking French food, computers and finding enough hours in the day for all of them.

A clean laboratory is rather like an operating theatre — a working environment in which a high standard of cleanliness is maintained. However in this case we aspire to 'chemical cleanliness' rather than freedom from dangerous micro-organisms. Chemical cleanliness does not mean paying extra to the night cleaning staff for a better job, nor does it mean avoiding the use of dirty, unwashed beakers.

Chemical cleanliness means providing an environment that is free from external sources of contamination, e.g. airborne dust, dandruff, fingerprints, fumes, smoke, chocolate vapour, spittle, corrosion products, etc that can come into contact with a sample undergoing analysis. This is where the idea of a clean laboratory comes in.

Clean laboratories are not unique to chemistry. There are many applications which require a dust-free, low contamination environment. For example, the preparation and manufacture of integrated circuits is a good example of a process that must be carried out in this way.

In trace element analysis, much of the inspiration for the design of clean laboratories and clean working methods is a direct result of the pioneering work of Clair Patterson at Caltech in the 1970's. Patterson, with his colleague Dorothy Settle, carried out very careful analyses for lead in samples from remote locations, paying scrupulous attention to defining, measuring and minimising sources of extraneous lead contamination.

Their work[1,2] showed beyond doubt that conventional methods of sample handling and analysis, no matter how carefully they were carried out, were subject to order of magnitude errors because of contamination artifacts. As a result, the great majority of Pb analyses with results reported in the sub-μg/g (parts per million) are meaningless. Interestingly, this alarming state of affairs produced a negative, head in the sand, reaction from analysts generally, especially within U.S. federal and state agencies making use of analytical information for regulatory purposes.

There is still an almost universal failure to appreciate that certain areas of study are beyond the capabilities of long-accepted working methods, even though Patterson's findings have been amply confirmed by other research groups[3]. We can demonstrate this graphically using the data in Figures 1 and 2. These show published analyses of zinc and copper in seawater as a function of the date of publication. In each case, note the appearance from the late 1970's onwards of results orders of magnitude lower than all the others. These have nothing to do with the fortuitous selection of samples naturally low in these trace metals — they are the only data that are correct!

And yet obviously erroneous results continue to appear in publications, and will continue to do so until the analytical problems of this type of work become more widely appreciated.

As a result of the accumulated experiences of the last 10 to 15 years, we consider it realistic to assert that:

> All analyses for the commonly studied trace elements in aqueous samples at levels of a few μg per litre are meaningless unless the analyst has a demonstrated capability to conduct the same analyses reliably at levels at least one hundred times lower.

For some elements that are particularly susceptible to contamination artifacts because of their high mobility and availability (notably Pb and Zn) the threshold level for meaninglessness would have to be raised to a few tens of μg/litre.

At the time of writing, there are probably fewer than a dozen laboratories in the world where this criterion would be met as a matter of routine.

Notice that this statement makes no mention of clean laboratories. We have done this in an attempt to dispel the notion that a clean laboratory is a universal panacea for the problems of trace element analysis at low concentrations. It isn't. In fact, even the most carefully designed clean laboratory would be almost useless unless it was used properly. The procedures and working methods used within a clean laboratory are the real secret to success in minimising contamination artifacts.

In attempts to publicise the importance of clean laboratories in trace element analysis, Patterson has often used the amusing analogy that conducting trace element analysis in an ordinary chemical laboratory is as appropriate as carrying out bone marrow surgery at the local tip. We would extend his remark by stating that to use the working methods of an ordinary chemical analysis in a clean laboratory context is as appropriate as having your bone marrow transplant done in a sterile operating theatre with a laser microscalpel wielded by the local barber.

But are clean laboratories really necessary for anything except the analysis of very pure samples collected from remote parts of the environment, e.g. open ocean water, alpine waters

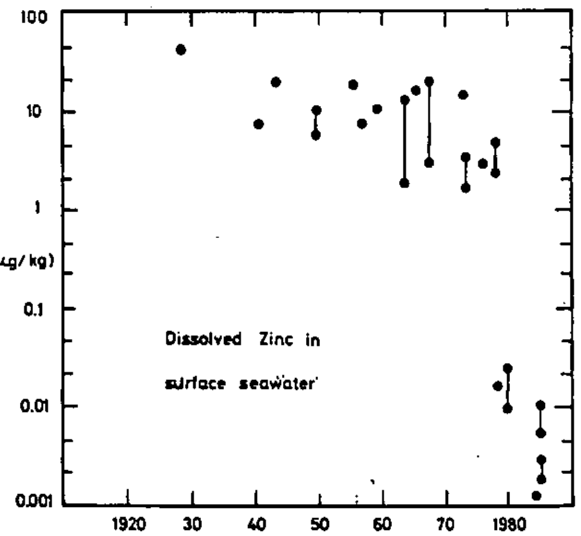

Figure 1: Dissolved zinc in surface seawater, published data, 1920-1985.

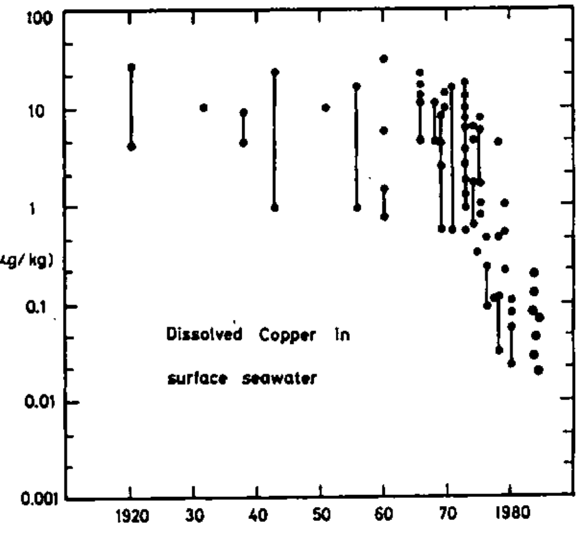

Figure 2: Dissolved copper in surface seawater, published data, 1920-1985.

and polar ice and snow? For a time it was held that the analysis of other materials, including foodstuffs, biological tissues and water samples from less remote parts of the environment, does not require these specialised techniques because the concentration range under study is high enough to make contamination a minor problem. Recent experience[4-6] shows that this standpoint is not supportable. The suggestion that less remote parts of the environment (e.g. coastal waters, lakes, estuaries) are more abundant in trace elements is based on erroneous or inappropriate data, i.e. analytical data that is either wrong or which applies to water systems grossly contaminated by man's activities. Recent applications of the clean laboratory approach to coastal waters, estuaries and rivers confirm this view.

In many areas of science where the results of trace element analysis are made use of on a regular basis, e.g. clinical and nutritional work, the awareness of contamination artifacts is very low and one can only speculate about the magnitude of the likely errors introduced through inappropriate experimental techniques. On the basis of our experience with water analysis, we can state categorically that routine methods used for the collection, storage and handling of such materials as urine, blood and other physiological fluids are hopelessly inadequate for trace element analysis.

Developments in clean laboratory analysis have taken place at a time when interest in environmental trace metal chemistry has been growing exponentially. Unfortunately neither area of growth has been especially connected together. One of the reasons for this is the facility with which streams of numbers can be generated using modern analytical instruments of high sensitivity. The quality of the results is, however, completely dependent on the way in which the samples are handled during collection, transportation to the laboratory and analysis.

While geochemists have undoubtedly had a lot of fun producing and attempting to explain meaningless results, the main outcome has been a great deal of confusion about the properties and behaviour of different elements in the environment.

Instrumental methods such as flameless atomic absorption spectrophotometry[7], differential pulse anodic stripping voltametry[8], neutron activation and isotope dilution mass spectrometry[1,2,9] have detection limits of less than a picogram. At these levels the air in an ordinary laboratory becomes a virtual dust storm, bringing with it quantities of trace metals that exceed those being studied by orders of magnitude.

For this reason, reliable analyses are most readily accomplished by working in a particle-free atmosphere. All clean laboratories[10,11] have a pressurisation system where external air is forced through high efficiency particle (HEPA) filters before it enters the laboratory. Generally a high volume flow rate is used so that the internal air of the laboratory is replaced every few minutes. HEPA filters are capable of extracting 99.99% of particles larger than 300 nanometers.

The nature of air flow within the laboratory also influences the transfer of airborne contaminants. Turbulence can carry particles in the opposite direction of the air flow within the eddies that turbulence engenders. For this reason, most clean laboratories incorporate laminar-flow clean benches and exhaust hoods where a laminar-flow of air towards the worker at the bench will ensure the integrity of samples. This air flow equipment can be combined with the pressurisation system, as it is in our laboratory.

Commercially designed clean rooms, such as those used for integrated circuit manufacture, do not make successful clean laboratories for chemistry without substantial modification. Because of the chemical reagents used, corrosion and wear problems within the laboratory will give rise to problems with time, and this must be avoided at the design stage.

The key to successful analysis lies in the control and measurement of all external sources of the element being analysed as the sample is handled. This applies equally to the collection and handling of the sample in the field as it does to the work carried out in the laboratory, especially since many of the clean laboratory facilities may not be available in the field. Contamination may occur at any stage of the analysis scheme, starting from the point of collection. Workers must take care with regard to contaminants from clothing as well as themselves. Hair and skin contain appreciable levels of copper and zinc. Problems with these sources must be avoided by the use of particle-free protective clothing i.e. disposable cellulose/PVC overalls, gloves, masks, booties and caps. All these items must also be very low in heavy metals.

In our experience, precautions of this nature are implemented fairly easily in a clean laboratory. The special nature of such a working environment, the protective clothing, masks, gloves and other rigmarole usually engender a stricter attitude in the working methods of analysts working there, especially as skill and understanding develops. Accordingly, the principal problems in ensuring reliable results generally come from those parts of the analytical process that must, of necessity, be conducted outside the laboratory. For this reason, especially rigid precautions must be applied to how sampling and sample handling is carried out.

As an illustration, we will describe the routine procedures used by our group for sampling surface waters (e.g. of rivers, lakes and the sea). First of all contamination of the sample container must be minimised by choice of appropriate materials and precleaning methods[12]. Only high quality conventional polyethylene or Teflon plastics are suitable for sample storage. Glass and other plastics introduce gross contamination at the baseline level. Containers are cleaned by soaking in hot 50% nitric acid for a few days, rinsed out with high-purity water and then filled with a high-purity acid solution (typically 1-2% HCl) and sealed inside two polyethylene bags, the inside one of which has been also acid-cleaned. The containers remain in this form until they are used.

Two bags are used to prevent the surface transfer of contaminants from the outside, through the agency of the samplers hands, onto the bottle surface and thence into its interior.

In the field, samples are collected from a small boat by hand-dipping beneath the surface. The sampler wears shoulder length polyethylene gloves, and never touches anything else except the sample container. A second person, also wearing gloves, sees to the unpacking of the sample bottle. Here, a rigid protocol is adhered to. Unwrapping each bag requires touching successive clean surfaces that have not been exposed since packing in the clean laboratory. The sampler's assistant changes gloves each time an external surface is touched.

During this operation, the boat is slowly rowed forward into clean water to avoid sampling water that has been affected by materials leaching from its hull. Thus three people are required for the collection of samples using a small boat. The two people involved directly in sample collection wear plastic clean room suits as a precaution.

Techniques for sampling deep waters in a clean way are equally sophisticated[13]. We use all-plastic sampling devices which can be prepared in a shipboard clean laboratory. They are lowered down on a non-metallic carbon-fibre based cable (Kevlar) and remotely triggered at any required depth. An essential feature of the sampler is a pressure activated valve system which keeps the sampler sealed until it is about 10-15m below the surface. In this way the internal surfaces of the sampler are not exposed to contaminants emanating from the ship itself (sewage, engine room fumes, anti-fouling paints, rust etc).

For applications in other areas of analysis, clean sampling techniques must be developed separately since they will depend very much on the nature of the sample. However, even simple operations like shovelling a sample of snow or dissecting a piece of biological tissue pose formidable problems when they must be converted to a 'clean' form[14].

It is not in the scope of this paper to discuss analytical methods. Indeed as a general rule the analytical methods used are quite conventional. In our experience, success at implementing a given method of extractive preconcentration or selective analysis scheme depends almost entirely on how successfully the chemical reagents involved can be purified and how clean the apparatus that must be used can be made. By way of example, we use mostly Teflon laboratory equipment in our clean lab. This equipment does not go into general circulation so that it never becomes exposed to extreme concentrations of the elements we commonly analyse. Reagents are purified in a variety of ways — mineral acids by sub-boiling distillation in quartz[15], solvents by acid extraction. Other methods used include isothermal distillation (useful for NH_3) and vacuum sublimation.

As a general guideline to analysis design in clean laboratories, it is desirable to arrange for the chemical and physical treatment of the sample, whatever its nature, to involve as few steps as possible. Each operation represents another opportunity for contamination to be introduced.

SUMMARY

There is only one criterion in chemical analysis, and that is the requirement that the analytical results ought to be as accurate and as precise as possible. Considerations of cost or speed of analysis must always be secondary to this. The application of clean laboratory methods to geochemical studies has lent a new dimension to the concept of accuracy — no longer can one be complacent about the results of trace element analysis in any field even being of the correct order of magnitude.

It is fairly certain that most of our supposed knowledge of how trace elements behave geochemically is based on completely meaningless information, and as more reliable data becomes available the textbooks will have to be rewritten. Our criteria for environmental management are also based to a large extent on the same information, and will also have to be revised accordingly.

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THE MANAGEMENT OF CHEMICAL WASTE

Norman G. Thom

National Environmental Chemistry and Acoustics Laboratory, Dept. of Health, Auckland.

Norman Thom was elected a Fellow of the Institute in 1982 and was Auckland Branch Chairman in 1983. He is Scientist in Charge of the Health Department's National Environmental Chemistry and Acoustics Laboratory (NECAL) in Auckland. NECAL's activities have extended into areas of toxic and hazardous waste disposal in recent years and current tasks include developing the technical basis from which the Department can produce guidelines. Chemical wastes studied to date include copper chromium and arsenic from timber treatment and organic lead from petrol storage facilities. Projects about to start include disposal of pesticides and other heavy metals.

Chemical wastes, at least in the minds of the public, are synonymous with hazardous or toxic wastes. There is growing evidence of concern, both overseas and locally, regarding long term environmental contamination which may result from irresponsible or inadequate disposal measures. It has been only during the last decade that many industries in developed countries began to give serious consideration to the solid wastes they were generating, even those wastes that could be regarded as toxic or hazardous. During this period, public concern regarding existing practices has resulted in greater controls and a more informed approach to the management of the production and disposal of such wastes.

OVERSEAS LEGISLATION

The range of management approaches introduced by legislation in recent time can be briefly reviewed by considering the situation in the United Kingdom and the United States.

In UK specific legislation controlling chemical wastes[1] has existed since 1972. A comprehensive system for licensing disposal facilities now exists. Overall a pragmatic approach has been developed with licensing and disposal functions being controlled by regional Waste Disposal Authorities. Comprehensive advice on specific wastes is provided by the Department of the Environment through an excellent series of Waste Management Papers[2]. Figure 1 illustrates disposal methods utilised in England and Wales, showing how landfilling is widely used. The House of Lords Select Committee on Science and Technology conducted a review[3] and in 1982 reported that landfilling, and the codisposal of suitable chemical wastes with normal municipal refuse, were acceptable practices. They stressed the need for proper site selection and the availability of adequate scientific resources to assist waste disposal authorities. The government response to this review included

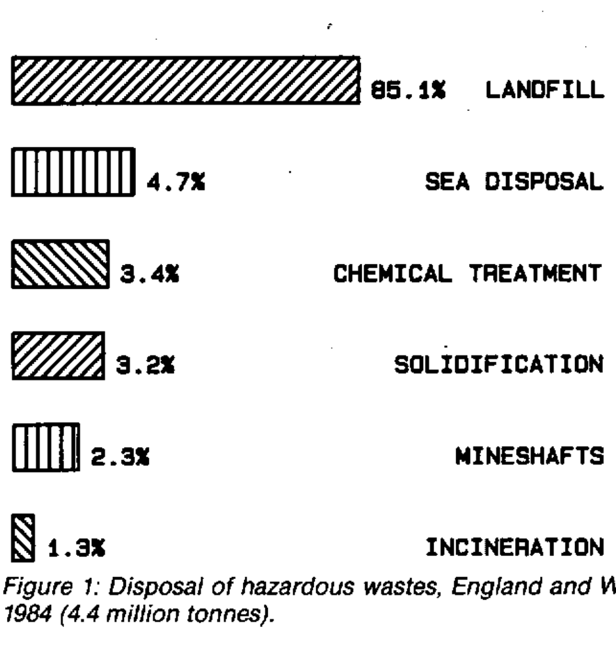

Figure 1: Disposal of hazardous wastes, England and Wales, 1984 (4.4 million tonnes).

the establishment of a small centralised Hazardous Waste Inspectorate. The first report of this group has just been released[4] and shows that all is not well. They indicate widely disparate attitudes among waste producers, contractors and disposal authorities ranging from "the thoroughly professional to the downright neglectful". While specific environmental damage could not be demonstrated many practices showed ignorance or disregard of technical advice which was readily available. In particular many landfill operators appeared ignorant of the findings of scientific research which should have been the basis of an informed hazardous waste management scheme.

USA has had controlling legislation[5] since 1976, but a further enactment[6] in 1980, which has become known as Superfund, was introduced to correct past mistakes. Its liability provisions are having a marked impact on current and future chemical waste management practices. Briefly, these prevent the contracting out of liability for hazardous wastes. Any person or company, that at any time had some responsibility for the production, treatment, transport or disposal of a waste subsequently found at a "problem" site, can be held as a "responsible person" for the clean-up of that site. Generally a cradle to the grave approach to hazardous waste management was introduced and these imposed design and operating parameters intended to ensure proper treatment. A 1984 Congress review of practices however led to a major overhaul of approaches. Concern was expressed that the amount of hazardous wastes being produced in USA was far in excess of that previously estimated, and that reliance on landfilling for disposal was continuing unabated despite widespread concern regarding groundwater contamination. They reached the conclusion that there is no such thing as a "secure" landfill particularly for liquid chemical wastes. Amendments to legislation were passed directing USEPA to promulgate rules prohibiting land disposal of specified chemical wastes. These prohibitions would take effect from given dates unless the EPA has shown to a "reasonable degree of certainty" that the land disposal of such wastes will not affect public health or the environment. Five years has been set for the review of all hazardous wastes, with dioxins, arsenic, cyanide, mercury, lead and other halogenated organics being included in early reviews.

NEW ZEALAND

A review of the local situation[7] has illustrated that even on a population basis the amount of hazardous wastes produced is small. We do however rely on land disposal, particularly codisposal with municipal refuse, for most of our chemical wastes. There is no consolidated legislation controlling the disposal of any but radioactive wastes or explosives. If we are to benefit from overseas experience and avoid future problems here, there is an immediate need to encourage and adopt an informed approach to hazardous waste management. In this respect, chemists have a major role to play.

WASTE MANAGEMENT CONSIDERATIONS

When faced with a chemical waste problem there are several factors which should be considered when deciding on a solution. These are given in the table below to act as a guide or check list.

1. Is the chemical composition of the waste known?
2. Is it hazardous?
3. Can the process be changed to eliminate this waste?
4. Is there any legislation controlling its disposal?
5. Can the waste be wholly or partially reused?
6. Can it be accepted into a public sewage system?
7. Which appropriate disposal methods are available:
   — Chemical treatment
   — Incineration/combustion
   — Containment in landfill
   — Codisposal with municipal refuse
8. Will pretreatment be required?
9. Will disposal processes be hazardous to operators, or create a nuisance to nearby population?
10. Will disposal create adverse environmental conditions long/short term
    — Air pollution
    — Water pollution
    — Land contamination

TABLE 1:
Hazardous Waste Management: Essential Considerations

Disposal Options

Locally, there are three main options for chemical waste disposal, namely:
— Chemical treatment
— Incineration or combustion
— Landfilling

Chemical Treatment and Incineration

Chemical treatment is waste specific, **sometimes** requiring complex chemistry and dedicated process equipment. This is not always the case however, e.g. toxic cyanides may be converted to nontoxic cyanates by treatment with hypochlorite in simple tanks. Some chemical wastes may also require pretreatment to render them suitable for landfill disposal.

Many organic wastes may be destroyed by combustion. Generally, but not always, high temperatures in excess of 1000 degrees Celsius for more than 1 second in the presence of excess oxygen is required. There are some facilities that would be suitable in this country[8]. Cement kilns[9] have been shown to effectively destroy PCBs during local trials. Destruction efficiencies in excess of 99.9% have been shown[10] for contaminated waste streams burned in industrial boilers which have been designed for high fuel combustion efficiencies.

Landfilling

Disposal of chemical wastes by landfilling can take either of two forms, namely containment, or attenuate and dispersion. In either case the chemical waste may be buried separately or codisposed with normal municipal refuse.

Figure 2 illustrates a containment landfill using a synthetic liner. The objective is to completely prevent the migration of any contaminant. Unless processes are promoted to degrade the chemical waste, the result will effectively be land storage, relying completely on the long term integrity of the liners used.

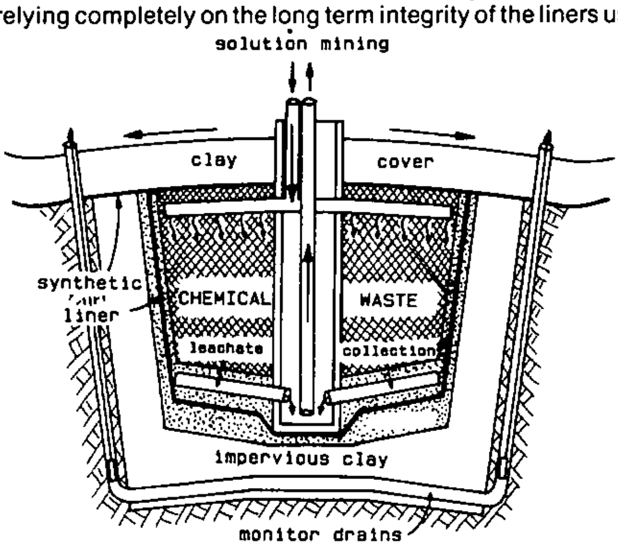

Figure 2: Containment with synthetic liner

Experience with liners to date is limited but a conservative estimate may give an expected life of 30-50 years. Thus re-excavation and re-siting may be necessary. Alternatively, facilities may be incorporated to degrade the chemical waste over time. For example, solution mining and reinjection may allow chemical or biological treatment outside the landfill. This approach is being incorporated in the new containment landfill for Ivon Watkins Dow at Waireka, near New Plymouth. It is not considered that this type of containment landfill will be needed for any but intractable special industrial waste.

Containment landfilling is generally achieved without the use of synthetic liners (see Figure 3). These would be sites surrounded by deep layers of impervious clays or unfractured rock. Alternatively, they may be constructed with compacted clay liners. Both types would incorporate drainage to prevent ingress of groundwater and to remove leachate. The landfill leachate thus collected can be directed to public sewers or other treatment processes.

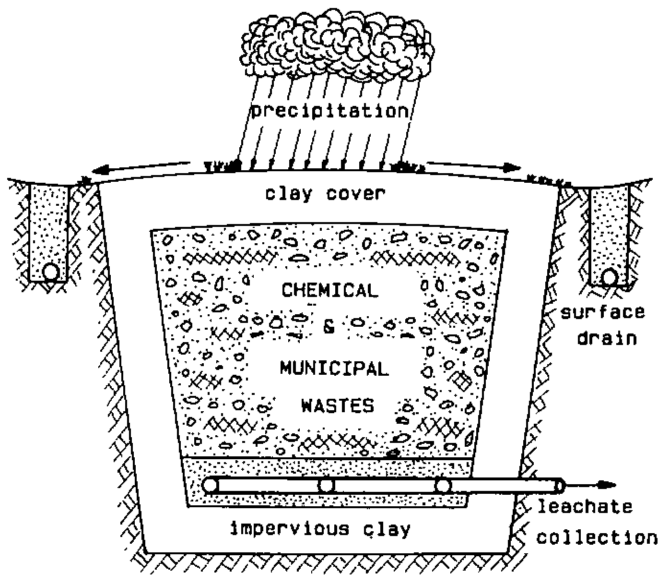

Figure 3: Containment Landfill

The more commonly used landfill disposal method utilises attenuation and dispersion. This is illustrated in Figure 4. Generally in practice this involves the codisposal of the chemical waste with normal municipal refuse at a landfill operated by a local council. In this context attenuation relates to the removal or reduction in concentration of the hazardous characteristics by physical, chemical or biological processes within the

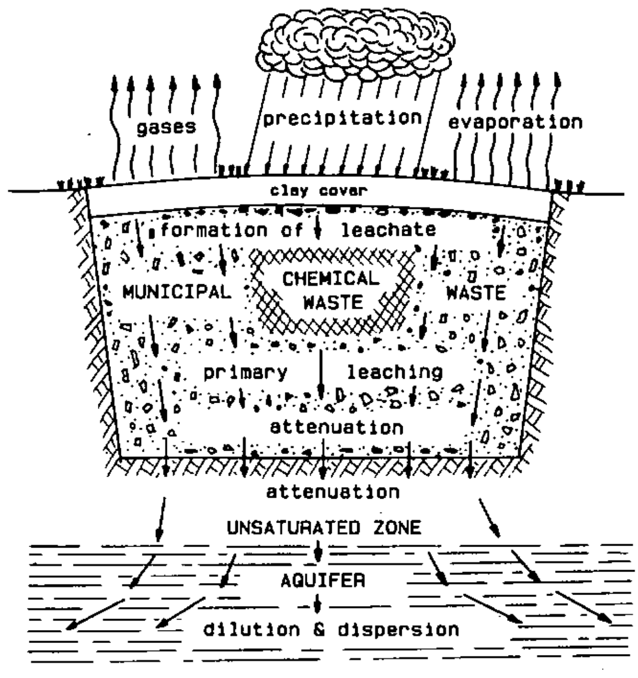

Figure 4: Attenuate and Disperse Landfill

landfill and its environs. These have been discussed in more detail elsewhere[11]. Simple examples would be solubility in the landfill environment, dilution with other leachate and groundwaters, precipitation and coprecipitation, particularly of heavy metals, sorption on to refuse and clay particles or biological decomposition. Chemists considering chemical wastes for codisposal must review all these processes. Consideration must also be given to potentially remobilising processes (such as pH change) which may act on the waste over time.

SITING AND MANAGEMENT OF LANDFILLS

Landfilling of chemical wastes will only continue to be acceptable in this country in the long term if landfills used are properly sited and managed.

It should not be assumed that every local authority landfill has been suitably sited to accept chemical wastes. Many factors including the hydrology and geology of the area must be taken into account. A numerical method for assessing the suitability of a landfill has been proposed by Le Grande and a review of this approach[12] confirms its general applicability to landfill selection in Australia and New Zealand. Local consultants are available to assist in site evaluations where necessary.

Areas used for landfilling must be properly managed. This must include an understanding of the landfill processes, waste identification, record keeping and awareness of waste compatabilities at the least. An adequate level of scientific understanding is essential and this unfortunately implies a level beyond that normally found responsible for landfill operations in all but the larger local authorities in this country. In order to achieve a situation giving an adequate number of properly sited and managed landfills for the codisposal of chemical wastes in this country it may often be necesary for local authorities to combine regionally for this purpose. Some financial incentive is now available in that the Department of Health can subsidise the cost of conducting waste surveys, site investigations or the development of waste management plans.

LABORATORY TESTS

Effective hazardous waste management requires that the chemical composition and other relevant characteristics of the wastes are clearly identified. Not all wastes will be suitable for codisposal and there is no one laboratory test that illustrates conclusively that landfilling is the appropriate option. The rate of primary leaching of contaminants from the waste will however be a major factor, and this will be influenced mainly by pH, and to a less extent by the redox potential of the landfill environment. Laboratory scale leaching tests have been developed in USA[13] and UK[14]. Both use synthetic leachate buffered to pH 5.0. The USA test is a simple extraction at a low solid to liquid ratio whereas the UK method is repetitive and batchwise with a higher solid to liquid ratio. Both methods have been compared[15] and give similar indications of total leachability. The UK method, as illustrated in results shown in Figure 5, gives a better indication of leaching pattern over time and as such is preferred for use in this country.

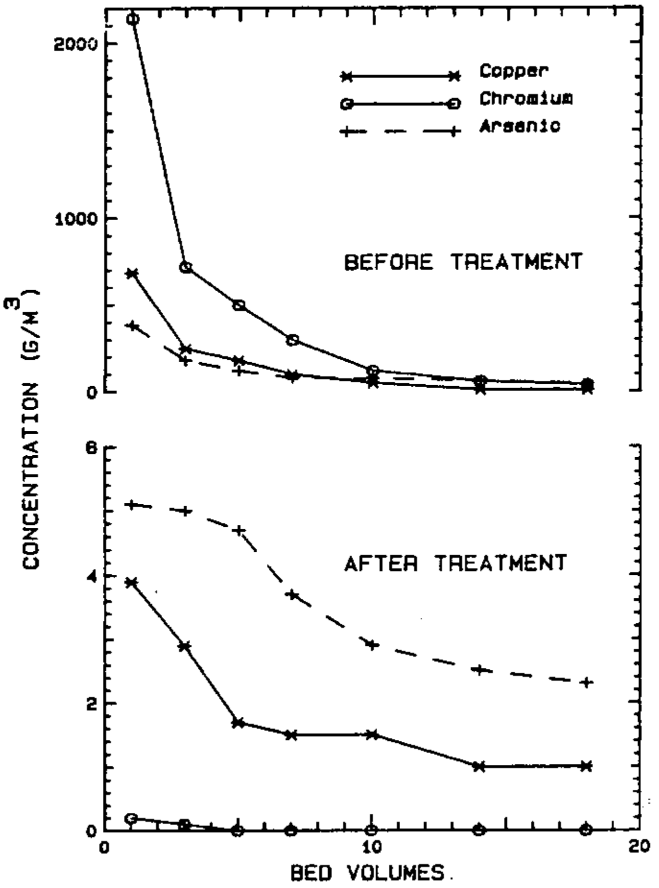

Figure 5: Leaching behaviour of timber treatment wastes, before and after treatment to reduce leaching.

CONCLUSION

The management of hazardous chemical wastes in many countries overseas has given grounds for considerable concern. There is a clear indication that disposal practices, particularly those involving landfilling have in many cases left a lot to be desired. Fortunately New Zealand does not have large quantities of chemical wastes for disposal, but there needs to be a more informed approach to the management of these wastes if future problems are to be avoided. Full responsibility for these wastes should not cease as it leaves the works site, in drums, tankers or otherwise, with the thought that it then becomes somebody else's problem. Effective management of chemical wastes requires a wide range of expertise of which a major contribution should be made by chemists. Those with some responsibility for the production or disposal of chemical wastes should consult with the appropriate local authorities so that a better understanding of the processes involved and improved long term management of chemical wastes can be achieved.

ACKNOWLEDGEMENT

The approval of the Director General of Health, Department of Health, for the publication of this article is acknowledged.

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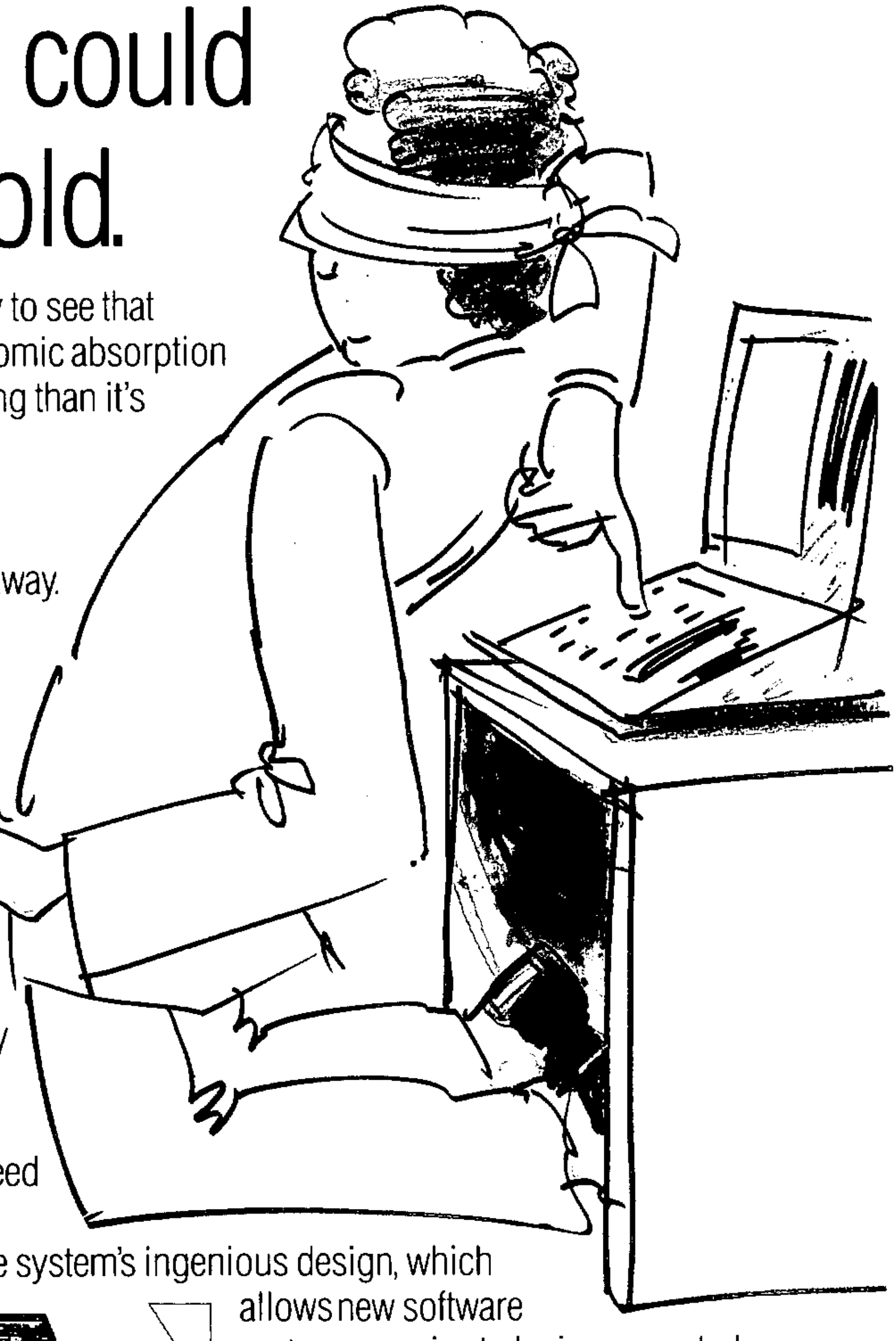

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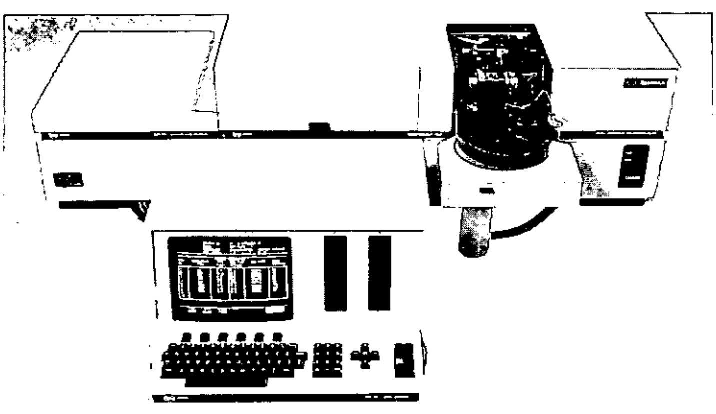

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__Tom Clarkson__ graduated Ph.D in physical chemistry from Victoria University in 1972. Since 1976 he has been on the research staff of the New Zealand Meteorological Service in Wellington. His major research interests are in tropospheric trace gas chemistry and dispersion in the atmospheric boundary layer. Current projects include measuring trace light hydrocarbons and fluorocarbons in the troposphere over New Zealand and Antarctica.

ACID RAIN IN NEW ZEALAND: IS IT A PROBLEM?

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INTRODUCTION

The Scandinavian countries are probably the most concerned with regard to acid rain effects observed worldwide, although not the most seriously affected, with Eastern Canada and USA a close second. Of Sweden's 85,000 lakes greater than one hectare in area, some 18,000 are considered to be acidified, and about 9,000 have damaged fish populations. In addition salmon stocks in many of the rivers discharging to the west coast are reduced. A similar situation exists in Norway[1]. In Germany it is estimated that 530,000 hectares of forest are affected at an annual cost of 900 million D.M.[2], and a recent report[3] indicates an increase over the last year of 16% to over 50% of trees damaged by acid rain. Recent reports[4] are suggesting that some of this forest dieback could be due to a virus infection.

THE NATURE OF ACID RAIN AND THE EUROPEAN SITUATION

There are two types of acid rain described as dry and wet precipitation. Both types originate from sulphur and nitrogen oxides formed during the combustion of fossil fuels in industrial furnaces, power station boilers, or motor cars.

Dry precipitation is generally most damaging near the source, and results from direct contact between the acid gases, largely unchanged by oxidation with the air, and the vegetation, not necessarily through intermediate solution in raindrops or fogs. Wet precipitation or true acid rain on the other hand, is generally formed at greater distances from the source as the acid gases become oxidised during travel downwind.

Both SO_2 and NO are relatively slowly oxidised in the atmosphere to produce SO_3 and NO_2 and ultimately sulphuric and nitric acids. This explains why wet acid precipitation, or true acid rain is generally a long range phenomenon.

Pure water has a pH of 7, but all rainwater is made slightly acid by the solution of natural atmospheric carbon dioxide to produce weak carbonic acid with pH of 5.6. Therefore rainwater acidification should not be considered significant until the pH falls below about 5. Values in the range 5 to 3 or below have been found in Europe and North America, and Johnson et al[5] have suggested that the dissolution of normally insoluble soil elements such as aluminium cannot be expected until the rainwater pH falls to 4.6 or below.

Specific conditions are required before a lake or river becomes acidified. It is likely that the neutralising capacity of even a well-buffered soil could be removed by the continuing action of acid rain. Slow depletion of alkaline soil elements over several decades may have exhausted the soil's natural neutralising capacity in many areas affected by acid rain, which in turn may be responsible for the quite acute acidification of lakes now seen in those areas.

In the Northern Hemisphere, sulphur emissions are responsible for 90% of the acid rain problem. For example, Table 1 shows data for SO_2 emissions and depositions most significant to Scandinavia, abstracted from the work of Highton and Chadwick[8,9]. As the ratio of NO_x to SO_2 will be similar worldwide, oxides of nitrogen have not been considered separately in this paper.

Table 1

European SO_2 Emissions and Depositions (KT/year)

Emitters

	UK	Norway	Sweden	FRG	GDR	USSR	Other*	Totals (Rec'd)
Receivers (from abovenamed sources)								
UK	1,620	-	-	50	26	-	311	2,007
Norway	96	48	24	48	53	19	293	581
Sweden	84	19	199	84	101	58	556	1,101
FRG	173	-	-	1,346	283	7	934	2,743
GDR	53	-	-	204	1,193	7	375	1,832
USSR	247	12	91	456	679	8,664	3,822	13,971
Other	1,977	61	196	1,322	1,665	16,745		
Total (Emissions)	4,250	140	510	3,510	4,000	25,500		

* Includes acids falling on the sea.

It is evident from Table 1 why the Scandinavians are so concerned. They are the only people that receive more SO_2 than they emit. On the other hand UK exports over 62% of its SO_2 and receives very little in return from overseas because the prevailing westerly winds reach UK from across the Atlantic Ocean.

A recent report[10] quoting data from UNECE indicates only 20% sulphur imports for UK against a massive 82% imports for Sweden and 92% for Norway.

ACID RAIN IN NEW ZEALAND

The situation in New Zealand is very much simpler in that there are only two sources of acid rain that can affect it: the indigenous SO_2 from domestic and industrial sources, and imports from Australia.

Indigenous Sources

A list of the major sources within New Zealand is presented in Table 2 and is referenced elsewhere.[6]

Table 2

New Zealand Sulphur Dioxide Emissions (KT/year)

	SO_2 Emitted
Coal burning, not power stations (0.6%S)	18
Huntly Power Station (0.22%S Coal)	11
Marsden Point Refinery full expanded	26
Meremere Power Station (0.19%S Coal)	3
Pulp Mills (Kawerau and Kinleith)	8
Aluminium Smelter at Bluff	7
NZ Steel, expanded	2
Fuel oil and diesel burnt at 3% and 0.3%S	31
Other industries and contingency, add 5%	5
Total	111

This shows that the total SO_2 emissions over the whole of New Zealand amount to 111,000 tonnes per year, only about 2.6% of the UK total. The proportion of New Zealand emissions retained in New Zealand may be less than in UK, depending on whether the discharges are from high or low level. A lower value of 15% has been quoted where emissions are from high level eg, from power stations.[11] An average value of 25% is probably more realistic for New Zealand which means that some 28 KT per year of SO_2 is retained.

Geothermal emissions of sulphur are mainly in the form of hydrogen sulphide which has little significant local effect apart from odour impact[6].

Australian Sources

Only the eastern states of Australia will be significant to New Zealand in view of the vast distance from Western Australia. Table 3 gives a summary of SO_2 emissions including fuels burnt and the main industrial sources (references elsewhere[6]). The Mt Isa smelter has been included because it is such a large source but it could be said to be too remote from New Zealand to be significant.

Table 3

Australian Sulphur Dioxide Emissions

Industrial Sources	Annual Amount MT	SO_2 emitted KT/year
Black coal burning (0.5%S)	54.3	543
Brown coal burning (0.25%S)	33.2	166
Heavy fuel oil (2%S)	3.02	121
Middle distillates (0.2%S)	6.86	27
Five aluminium smelters	0.84 Al	23
Copper Smelter (NSW)		67
Steelworks (NSW)		23
Oil refining (not WA)	31 crude	104
Mt Isa lead and copper smelting		588
Estimate of 5% of above for other industries		83
Total		1,745

Hence total sulphur dioxide emissions per year from Australia relevant to New Zealand are about 1.75 million tonnes. The fraction of this sulphur reaching New Zealand will depend on the proportion of the time the wind blows towards New Zealand, the amount absorbed on land and by the Tasman Sea, less that washed out by rainfall on the way over.

THE TRANS TASMAN MODEL

Various models have been proposed to calculate the survival in the atmosphere and rate of deposition of long range pollutants. Fisher[11] presents a useful summary of some of these, and concludes that the simple "box model" is one of the best for calculating annual averages. In the case of sulphur oxide drift from Australia to New Zealand we have defined a box bounded by Brisbane to Adelaide at the Australian end and

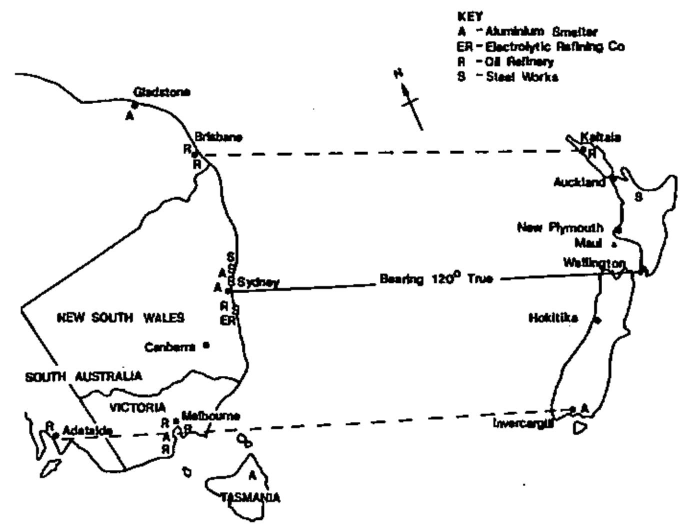

Figure 1: Significant sulphur oxide sources to be considered in determination of acid deposition on New Zealand. The area of Australia shown contains about 90% of the population.

Kaitaia to Invercargill at the New Zealand end. This gives a rectangular area about 1,500 km wide and about 2,200 km long, approximately equal to the coast to coast distance (see Figs 1 and 2). The centreline of the box lies on a bearing through Sydney and Wellington, 120° east of north. We have applied this box model to the Tasman Sea case in such a way as to put an upper bound on the amount of sulphur of Australian origin that will reach New Zealand each year. Within the box all pollutants are assumed to be uniformly dispersed vertically throughout its volume, thus, in the case of SO_2 combustion products, chimney plume rise is assumed to generate a uniformly mixed layer 1,000 metres high at the upwind boundary of the box. Assumptions made are that sulphur dioxide and sulphate aerosol fall-out at a uniform rate in the box of 1.0 and 0.1 cm per second respectively and that SO_2 oxidises to sulphate at about 2% per hour during movement downwind[12,13]. Pollutants remaining in the box are assumed to remain uniformly distributed vertically.

Fuller details of our calculations are given elsewhere[6], and only a summary of our findings are given here. We have concluded that a total of 28 KT/year of sulphur mainly as SO_4 falls out over New Zealand from Australia, being about 3% of the original emission in a typical year. The assumptions we have made mean that this is a maximum figure; the actual amount in any one year will certainly be less than this.

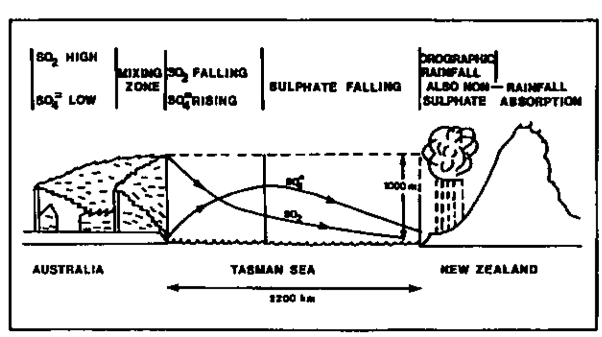

Figure 2: The box model. The plots of SO_2 and $SO_4^=$ indicate their changing importance during passage across the Tasman Sea.

NEW ZEALAND ACID RAIN LOADINGS COMPARED

The total fall-out on New Zealand soil, expressed as sulphur, by both wet and dry deposition amounts to 42 KT/year, (including 14 KT/year from New Zealand sources) ie, an average loading of 0.15g sulphur per m² per year over the whole country. The comparison between New Zealand and Scandinavia, Europe, and UK, is summarised in Table 4[13–14]. Most of England is in the range 1 to 4 gS/m^2/year, on average 25 times higher than we have estimated for New Zealand[15].

Table 4

Sulphur Depositions Compared (gS/m^2 per year)

Location	Average	Maximum
Central Europe (Germany)	6.5	10+
UK (England)	4.3	7
Norway	0.9	3
Sweden	1.2	4
Australia (NSW+Vic+Q+SA only)	0.2	?
New Zealand	0.15 (model)	0.7 (est)

Table 4 shows that the deposition of sulphur acids onto New Zealand is on average eight times less than Sweden and about 40 times less than the worst area of central Europe.

In general New Zealand soils are deficient in sulphur and a large synthetic fertiliser industry supports regular and widespread topdressing with calcium superphosphate. Calcium superphosphate fertiliser contains 40% sulphuric acid by weight, and about one million tonnes per year is consumed in New Zealand for topdressing of farmland. It would seem therefore that much of the country may benefit from a slight increase in sulphuric acid rain, providing the concentration was not excessive and pH levels did not fall too low.

CONCLUSION

The present study has shown that acid rain is not a significant problem in New Zealand, and is never likely to be one unless there is a large and completely unpredicted increase in industrialisation or consumption of high sulphur fuels here or in Australia. Also, because the majority of our soils are sulphur deficient, small additional quantities of sulphate deposition may be beneficial in many hill country areas. We conclude that, providing there is a satisfactory level of sulphur dioxide dispersion by the use of high chimney stacks from our larger combustion sources, no damage from the effects of acidic sulphur compounds released in New Zealand is likely.

The conclusion supports the present high stack dispersion policy of the New Zealand Department of Health, which does not require flue gas desulphurisation unless local topography or poor dispersion conditions make this necessary. This policy therefore represents the best practicable means for the control of sulphur emissions in New Zealand for the foreseeable future.

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ATMOSHERIC CHEMISTRY IN NEW ZEALAND

Report on a workshop held in Wellington, 23 and 24 May 1985.

Over several years, those working in the field of atmospheric chemistry and air pollution had often mentioned to each other that there was a need to bring all those working in these fields together for a day or two to talk about what was being done in New Zealand, what should be done, and whether there were ways of combining our resources. This eventually led to a workshop meeting of research workers from the broad field of atmospheric chemistry in New Zealand, convened by the New Zealand Meteorological Service for two days in May 1985.

The meeting was attended by 60 chemists, physicists and meteorologists. The programme was divided into six major topics, for each of which one or two short review papers were presented. Several shorter prepared presentations then followed, to stimulate discussion or describe recent work, and then ample time for wide ranging discussions was always allowed. The main features from the sessions are outlined here.

Tropospheric chemistry

Dr David Lowe talked about the major chemical cycles of the lower atmosphere. He pointed out areas where puzzles remain, for example, the sulphur cycle does not balance. This may be accounted for by postulating that the oceans are a major source of dimethyl sulphide. Also within the sulphur cycle, improved knowledge of the mechanism of H_2S oxidation is also necessary — is it in the gas phase via atomic oxygen or is it in solution via ozone? Dr Lowe described the importance of the OH radical as an oxidising species in the troposphere and how a small perturbation in one atmospheric chemical cycle could significantly affect other cycles via changes in concentration of OH.

Dr Neil Gordon outlined how the Meteorological Service can routinely compute air trajectories using observed or forecast weather data. This facility has already proven useful in studies of natural and man-made trace gases reaching New Zealand from Australian or oceanic sources.

Stratospheric chemistry

This is a field of immense interest to chemists, but the experimental difficulties are such that little work can be done in New Zealand. A spectroscopic technique for measuring stratospheric ozone is used by **Miss Edith Farkas** of the Meteorological Service at Invercargill as part of a global study network. The long time series so far obtained is used for monitoring changes in the chemistry of large scale transport processes in this region.

Urban and industrial effects on the atmosphere

There are numerous groups in New Zealand working on the nature and effects of man-made air pollution. **Dr Bruce Graham** of the Department of Health reviewed the field, considering the different time scales involved. Examples of diurnal variations are found in the build-up and decay of carbon monoxide in an Auckland city street during a day, or the increases of smoke in the air of Christchurch on a winter night. Christchurch smoke and SO_2 were used as an example of seasonal variations of pollution, due to major seasonal changes in both source strength and dispersion conditions. Long term trends of pollutants in New Zealand cities are often decreases, for example SO_2 in Auckland, probably attributable to increased use of natural gas instead of coal. In further discussion **Mike Bulley, Terry Brady** and **Dahya Budhia** gave details of Department of Health monitoring of the special problems of Auckland and Christchurch.

Dr David Wratt explained the role of the Meteorological Service in the prediction of air pollution from major industries or urban areas. A knowledge of meteorological factors is essential to determining movement and dilution, chemical transformation and the eventual loss of pollutant to the ground. The Meteorological Service is now able to model and measure a wide range of weather parameters to aid predicting pollution.

Aerosols and clouds

Dr Howard Larsen reviewed cloud physics with particular emphasis on current and planned work in New Zealand with the instrumented Ministry of Transport Friendship aircraft. Projects and experiments now in their initial stages involve vertical and latitude profiles over New Zealand measuring size distributions and concentrations of aerosols in clouds. Subsequent developments will allow for chemical analyses and also trace gas sampling.

Also in this session **Dr John Duncan** of BRANZ described a project to quantify the problems of corrosion by airborne salt in New Zealand. So far it appears that New Zealand has far more serious problems than revealed by similar studies in UK and Australia. This means that even an inland city such as Palmerston North has a moderate to severe problem from sea salt corrosion.

Special topics in the Southern Hemisphere and Antarctica

New Zealand's geographical position gives a special advantage for studies of the clean marine atmosphere and for studies of the atmosphere of high latitudes and Antarctica. **Dr John Kidson** explained the meteorological aspects of the circulation at high latitudes, well understood on a broad scale, but needing much research on smaller scales and for determining mechanisms. **Dr Stephen de Mora** of Auckland University spoke of the particular advantages from a chemist's viewpoint of basing studies in New Zealand or Antarctica. For example, the extremely productive oceanic waters and high light flux suggests that Antarctica would be an ideal region to study the volatile sulphur cycle which is dominated by biogenic emissions and photochemical processes.

Carbon dioxide and the effects of atmospheric composition on climate

Dr Martin Manning of INS described 12 years of precise measurements of CO_2 in clean marine air at Baring Head near Wellington, as part of a global monitoring network. The effects of the steady increase observed were discussed by **Dr Brett Mullan.** The problem of the greenhouse effect and associated feedbacks, and their influence on global or local climates is particularly difficult for numerical modelers. **Dr Jim Salinger** explained how the use of historical records and reconstructions of past climates can be used effectively to give an indication of the temperature/rainfall relationship over New Zealand. It can be deduced that a general warming in the New Zealand region will lead to higher rainfalls in the north and east of New Zealand, with less rain in the far south.

After all the sessions reported here there was vigorous discussion, much of which has been recorded in a Proceedings publication, currently in press. This document will be sent to all those present at the workshop. Anyone who wishes to be added to the mailing list should advise Dr T. S. Clarkson, New Zealand Meteorological Service, P.O. Box 722, Wellington.

Tom Clarkson

SEARCH FOR THE FUTURE

The A. & N.Z. Association for the Advancement of Science (ANZAAS) is about to redirect its journal *Search* to provide a medium for the discussion of science and technology that will interest all those who are concerned with the impact on society and life in general today. The journal has been moving in this direction over the past two years under the editorship of Anne Moyal. The quality and quantity of articles arriving have made it difficult to fit all of them in as quickly as one would have hoped. Such support, however, is a sure sign that there is a need for a broad-based science publication in Australasia that can serve the whole community. This is entirely consistent with the aims that ANZAAS has always espoused.

With the retirement of Anne Moyal from the editorship in the middle of the year, the Council of ANZAAS decided to give a group of Victorians the chance to further the aims of *Search* starting in January 1986. The journal will be in the hands of an enthusiastic editorial committee, backed up by a group of eminent consultants and a team of correspondents who will cover events in Australia and New Zealand. Apart from ensuring that the citizens of these countries know what significant developments are taking place in the region, *Search* will draw the eyes of the rest of the World to what is happening south of the equator.

By concentrating science reportage in a readily accessible publication, ANZAAS and the editors believe that the extent to which Australians and New Zealanders are extending knowledge and adding to the quality of life will be appreciated to a much greater extent than before. So much that is done by local scientists is hidden at present in a vast literature spread over the whole of the English-speaking world. In future major advances will be seen by a wider audience than the specialised readers of research journals. *Search* will be a medium of enlightenment and discussion for use by anyone who can add a useful commentary to a matter of importance to the inhabitants of the region.

To encourage the maximum amount of participation in this exchange of ideas, the publishers of *Search* are inviting members of interested groups such as the NZIC to subscribe to the new-look journal at special reduced rates from 1986 onwards. The normal Library subscription will be $A60. Members of the Institute can obtain copies for personal use at the most attractive price of $NZ40 for six issues. To take advantage of this offer write to *Search*, C/o Blackwell Scientific Publications (Australia) Pty Ltd, 107 Barry Street, Carlton, Victoria, Australia 3053. (Article supplied by Basil Walby, Editor-elect, *Search*.)

CONFERENCES

Science and Theology in Action: 14-17 August, 1986, Massey University.

For further details contact the Conference Secretary, University Extension, Massey University, Private Bag, Palmerston North.

Chemistry in Occupational Hygiene and the Environment, combined RACI/FACS conference, 7-11 July, 1986, Darwin.

For further details write to the Secretary, GPO Box 363, Darwin NT 5794, Australia.

Ninth Australian Symposium on Analytical Chemistry, 28 April-1 May, 1987, Sydney. The symposium will highlight new developments in analytical research, including specialist meetings in carbohydrate chemistry, and laboratory automation. Secretary is Mr John Eames, P.O. Box 137, North Ryde, NSW 2113.

INDUSTRIAL NEWS

On the industrial scene in Southland, **Arthur Wilson,** General Manager of Southland Dairy Co-op, wil retire after many years at Edendale on 30th November. He was originally with the Southland Lactose Co. He will be succeeded by **Mike Corbett** who has come to Edendale from the Egmont Dairy Co., Taranaki. Southland Dairy Co-op are currently developing sterilisation techniques using solutions of sulphuric acid after some environmental problems arose from the use of nitric acid.

At Southland Co-op Phosphate Co., **Don Murdoch,** a graduate of the University of Otago, has now retired from the post of General Manager, and **Ian Dunce** has been promoted within the Company to succeed him. Also, several field officers and other staff will attend the N.Z.F.M.R.A. conference at Ardmore College, Auckland in December. High phosphate fertilisers are expected to dominate the discussion in both Agronomic and Production Technology sections of the conference.

South Oil, a company associated with Southland Co-op Phosphate Co., originally extracting oils from rape seed to be used as a diesel substitute, has had a particularly successful year in producing 350,000 litres of refined, food grade, rape seed oil. This represents 15% of the food grade oil currently imported into New Zealand. It is expected that 1986 will see the production of 1.5 million litres of refined oil with a value of approximately $2 per litre. South Oil is using plant, purchased originally from the Fletcher Co. and refurbished, to give a batch process for the refining, de-odorising and drying of rape seed oil. The Company is now producing two other products from rape seed — a high protein stock food, and an oil of high fatty acid content which they intend to sell to soap manufacturers.

FARMERS FERTILISER OPENS NEW PAC PLANT

New Zealand is now able to produce Poly Aluminium Chloride (PAC) for the first time, thanks to a $1 million-plus expenditure by Farmers Fertiliser Limited at its Morrinsville works. The company believes the water treatment chemical will be widely received by a variety of industries. Previously all PAC was imported, primarily from Japan. Farmers Fertiliser has obtained the exclusive license from Taki Chemicals of Japan to manufacture the chemical in New Zealand. Renovations to the building were required, along with new plant imported from Japan and adapted where necessary by the company's engineers. The result is a plant with production potential to cover any anticipated requirement in the New Zealand marketplace.

In 1984 the New Zealand market used approximately 200 tonnes of PAC; with the Think Big projects coming on-stream this figure is now closer to 500-600 tonnes per annum. This figure is predicted to double at least once with the long term prospect of increasing yet further.

Farmers Fertiliser Limited product manager, Paul Maynard says the local manufacturer of PAC will mean considerable advantages to local users particularly in availability. Poly Aluminium Chloride is a special basic salt of aluminium chloride designed to give much stronger coagulating power than ordinary aluminium and iron salts. It has proven benefits in the clarification of waste water, process water and problem raw water. It has been licensed and successfully marketed in UK, France, Germany, Italy and USA.

The company has set up a technical advice team to offer advice and carry out jar tests.

GOLDEN JUBILEE FOR NZFP

Xmas Eve, 1985, marks a milestone in New Zealand industrial history. Fifty years ago on that day NZ Forest Products Limited was incorporated, to take over and utilise the forest interests of bondholders in N.Z. Perpetual Forests Limited, a tree planting company at the time. Today, NZFP is the largest forest utilisation company in New Zealand, with a staff of more than 10,000, and shareholders in 64 countries.

To commemorate its 50th Jubilee, the company recently announced a number of grants and awards. Gifts of $10,000, and $5000 per annum over three years, have been made to the Auckland branch of the Crippled Children Society, and the Auckland Regional Orchestra, respectively. In Christchurch a total of $75,000 will be gifted at the rate of $15,000 per year to the Polytechnic, to assist with the establishment of a tutorship in Maori studies. Tertiary study grants for the children of NZFP employees — the NZ Forest Products Limited Jubilee Grants — have also been established, along wtih new Jubilee Scholarships, which are to replace the present David Henry Scholarships. The broad objectives of the latter — "for the advancement of education and knowledge in the academic and practical fields of forest maintenance and utilisation, ancillary and related services" — have been incorporated into the new scholarships, but the scope has been broadened to include marketing and new product development.

NZFP also recently announced the last of the awards under the David Henry Scholarships scheme. Four scientists have received awards, to a total value of $30,000. The receipts are **Dr. David Cown,** Forest Research Institute, **Dr Adya Singh,** NZ Forest Service, **Dr Munoo, Prasad,** MAF, and **Mr Graeme Bell,** NZ Particle Board.

Robert Chemicals Limited Opens New Sulphonation Plant

In October of this year Robert Chemicals Limited, a subsidiary of Shell New Zealand, opened a new $5 million sulphonation plant for the manufacture of detergent and personal care intermediates. The plant, based in Gracefield, utilises the latest in technology from the Italian company, Ballestra, although local content is over 50% for the complete installation.

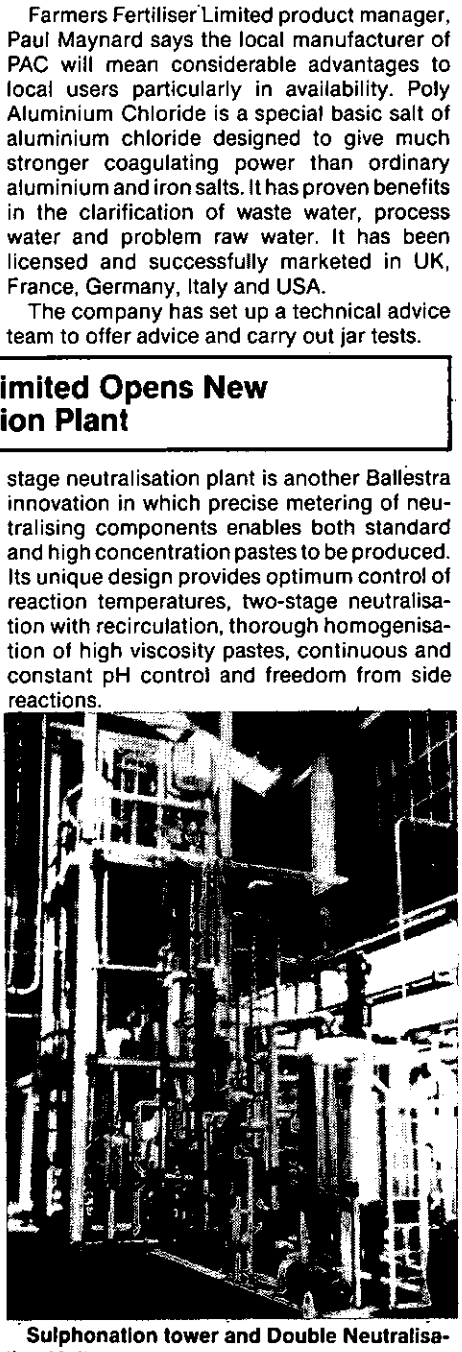
The process is based on the reaction of gaseous Sulphur Trioxide (SO_3) produced from elemental sulphur, in direct contact with raw organic feed materials. These base materials can include detergent alkylates, natural or synthetic fatty alcohols and alcohol ethoxylates, fatty acids, alpha olefins and other similar organic materials.

The rated capacity of the plant is 1,300 kg per hour of active material.

The plant incorporates a number of features, all aimed at ensuring the best possible quality of final product. Of these the major technical innovation is the thin film reactor in which sulphonation (or sulphation, depending on the nature of the raw material), takes place. Here precise control of reaction conditions yields the higher quality products.

This is crucially important as it allows local production of Detergent and Personal Care Intermediates which are otherwise difficult and sensitive to produce, such as those used in the preparation of shampoos and other cosmetic and personal care items, where clear, bright, high quality products are needed, without additional bleaching.

The liquid run-down from the reactor (a sulphonic acid) is pumped to the next section of the plant for neutralisation. The "Neutrex" two stage neutralisation plant is another Ballestra innovation in which precise metering of neutralising components enables both standard and high concentration pastes to be produced. Its unique design provides optimum control of reaction temperatures, two-stage neutralisation with recirculation, thorough homogenisation of high viscosity pastes, continuous and constant pH control and freedom from side reactions.



Sulphonation tower and Double Neutralisation Unit

DSIR TO SET UP NEW FOOD RESEARCH CENTRE IN SINGAPORE

The DSIR will set up a food research and development centre in Singapore towards the end of 1985. This was confirmed recently by an assistant DSIR Director-General, **Dr John Troughton.**

"This will have a very significant impact on our food exports in Asia. We must gain scientific and technical information directly from the market-place if New Zealand is to succeed in producing foodstuffs acceptable to this region," he said. Initially the new centre will concentrate on transforming New Zealand's horticultural and fish resources in to consumer-oriented added value products. Centre staff will also help New Zealand companies in joint venture projects as well as providing back up services to those exporting to the region.

The Scientist in charge of the new DSIR centre in Singapore will be **Mr Norman Lodge** who is a food scientist in the DSIR's Division of Horticulture and Processing. Mr Lodge is well qualified for his new position. He holds Master of Science degrees in Chemistry and Food Science and is a Fellow of the NZIC as well as of the New Zealand Institute of Food Science and Technology. For the past 25 years he has been associated with the food industry in England and New Zealand, and has a particular interest in applying scientific and technological information to the marketplace. Mr Lodge has visited South East Asia several times for the DSIR, particularly Japan where his efforts have lead to successful sales of Kiwifruit wine and a new health drink, Ergo — both developed by the DSIR.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COUNCIL NEWS

Honorary Fellowship. Professor G. B. Petersen presided at a telephone meeting of Standing Committee on 5 November. It was resolved to elect **Dr J. H. O'Donnell,** University of Queensland, who is the incoming President of the Royal Australian Chemical Institute, as an Honorary Fellow of the NZIC during his term of office. A Reader in Physical Chemistry, James O'Donnell initiated RACI's National Chemistry Week and was chairman of the organising comittee for its first three years.

NZIC-RACI Visiting Speaker Award. Professor B. J. Welch, Head of the Department of Chemical and Materials Engineering, University of Auckland, has been chosen as the 1986 NZIC-RACI Visiting Speaker to Australia. Barry plans to visit Australia in June.

Nominations of members of the RACI to visit New Zealand in 1987 under the terms of this award are required from NZIC and RACI Branches by 30 June 1986 for consideration by NZIC's Council in August. Career details and the titles of talks offered for presentation in New Zealand are required from nominees.

ACA-NZIC A. C. Kennett Memorial Award. Mr S. Wiktorek and **Mr F. W. Kolodziej,** Australian Iron and Steel Pty Ltd, Port Kembla, were presented with this award at the Australasian Corrosion Association Annual Dinner on 14 November at Conference-25 in Newcastle, New South Wales. Their winning paper "Evaluation of Coatings for Underground Oil and Gas Transmission Pipelines" was presented to ACA's 24th Annual Conference at Rotorua in November 1984.

ICI New Zealand Science Fair Award. In response to a request from our Second Vice-President, **Mr T. R. Hitchings,** a grant of $600 has been made to assist **Shaun Clarke, Andrew Easton** and **John Stephens** to accept an invitation to exhibit their project "Computer Controlled Titration" at the Science Fair in San Diego in April 1986. These pupils of Riccarton High School, where Terry Hitchings is Principal, were presented with the Premier Award of the 1985 ICI New Zealand Science Fair by **Mr R. H. Arbuckle,** Managing Director, ICI New Zealand Ltd, at the Auckland Institute and Museum on 28 September.

Part of the Premium Award Prize is an air fare to USA from Continental Airlines. The NZIC contribution is to a fund being raised so that all three boys may go to San Diego.

1986 Prizes. Entries close with the Administrative Secretary on 30 April 1986 for the Easterfield, ICI, Shell Industrial Chemistry and Student Essay Prizes. The Essay Prize is now $100.

The Shell Industrial Chemistry Prize is under review by Council at the request of its sponsors. As stated in the rules for this prize (see 1985 Yearbook page 35) "supporting documents... will be held to be confidential to the assessors". Applications may be made for this prize by NZIC members. Nominations for this prize also may be made by Branches or by corporate members of the NZIC.

"Chemistry in a Young Country". Copies of this NZIC Golden Jubilee publication are available from the Registrar, Box 29-183, Christchurch, at $10 each. Its 235 pages, written by 36 members, illuminate the development of Chemistry in New Zealand from 1850 up to 1980. It is an exciting story of men and women chemists and their work. For members with young friends considering a career in Chemistry this book is recommended as a welcome Christmas or birthday gift. Also, does your local library have a copy?

NZIC Services to Members. A salary survey is planned in 1986 probably with questionnaires sent to members in April for return by 1 May. The timing of this operation is to be confirmed at the Council meeting on 11/12 February 1986.

Young NZIC members, if approached by organisers to join a union, are recommended to discuss the options with their employers and NZIC Branch, which may refer to Council. The responsibilities of members are set out in the Code of Ethics published in the 1985 Yearbook. Copies of "Guidelines for Professional Employment", published in "Chemistry in New Zealand" in 1977 are available from the Registrar, P.O. Box 29-183, Christchurch.

Student members are referred to Branch secretaries for advice on applications for grants to assist them to attend the 1986 NZIC-NZBS Conference in Dunedin 24/28 August.

Branches are being sent details of an offer for an income protection policy to cover sickness or accident, which may be of interest to members not already contributing to such an insurance programme.

Recruitment. The list of newly elected members published in this issue shows that recruitment by the Institute of newly qualified and experienced chemists remains slow. The President is asking Branches for written comment on their recruitment plans for discussion by Council in February 1986. Have you been successful in encouraging a chemist colleague to apply for membership this year?

New Zealand Chemical Industry Council. In September the first Annual General Meeting of the New Zealand Chemical Industry Council was held in Auckland. An invitation to set out its aims in "Chemistry in New Zealand" has been accepted.

Council of the NZIC has indicated its support of the Chemical Industry Council's desire to harmonise and strengthen the industry's activity with particular emphasis on health, safety and environmental protection. NZIC's Environmental, Hazardous Chemicals and Science Policy and Public Affairs Committees are likely to be associated with this important new grouping of importers, transporters, storers and users as well as manufacturers of chemical products.

International Chemistry. Dr Robert Maclagan of the University of Canterbury has agreed to serve as liaison secretary for the NZIC with the Organising Committee in Hobart for a RACI-NZIC Conference there 19/25 January 1988 to mark Australia's bicentenary.

Dr Peter Cropp of Chemistry Division, DSIR, Lower Hutt, is arranging a visit by the Director of the UK Metropolitan Police Forensic Laboratory, **Dr R. L. Williams,** to New Zealand, probably 16/23 February 1986. Council has agreed to contribute to the cost of Dr Williams visiting Christchurch, Wellington and Auckland.

Professor Arthur Campbell has advised that **Dr R. D. Murray,** Reader in Chemistry at the University of Glasgow, will be visiting the University of Otago for the first six months of 1986. Dr Murray is an author of "The Natural Coumarins". His research interests are the structure determination of diterpenoids, natural coumarins and chromones and the synthesis of natural coumarins and naturally occurring insecticides.

IUPAC Affiliate Scheme. Members wishing to participate in IUPAC's Affiliate Membership Scheme as outlined in the blue pamphlet circulated to Branches are reminded to send NZ$20 to the Registrar, P.O. Box 29-183, Christchurch, for the 1986 subscription.

J. Rogers
Honorary General Secretary

7 November 1985.

Membership: The following applications and changes in status were approved.

Fellows: DURHAM, Reginald Alexander, MSc (NZ). 24 Kenny Rd, Auckland. (Consultant)
KNOX, Bruce Stanley, BSc. Post Grad School of O & G National Women's Hospital, Auckland. (Snr. Sc. Officer)
McCORT, John Graham, BSc. Carboline Coatings NZ Ltd, Auckland. (Managing Director)
OGILVIE, David James, BSc. Auckland Regional Authority. (Head Scientist, Water)
YOUNG, Harry, BSc (Hons) PhD (Otago). Divn of Horticultural Production, DSIR Auckland. (Head, Physiology & Chemistry).

Members: CROOK, Fred, BSc (Hons) (Manch.) Morrison P.I.M. Ltd, Auckland. (National Devel. Manager)
FUAVAO, Vili, PhD (New Mexico). The University of the South Pacific, Suva, Fiji. (Lecturer in Chemistry)
LAVIS, Angela, BSc PhD (Wales). Chemistry Divn, DSIR, Auckland. (Scientist)
PASCO, Neil Francis, BSc (Hons) PhD (Otago). NZ Agricultural Engineering Research Institute, Lincoln College. (Snr Res Officer)
SUCKLING, Ian Douglas, BSc (Hons) (Well) PhD (B.C.) Forest Research Institute, Rotorua. (Scientist).

Graduates to Member: DEMPSEY, Victor Joseph, BSc. Poultrymen's Co-operative Ltd, Auckland. (Chief Chemist)
DEVA, Manher Magan, MSc (Otago). BJN Holdings Ltd, Auckland. (Industrial Chemist)
GRAY, Michael John, BSc PhD (Cantuar). National Radiation Laboratory, Christchurch. (Scientist)
McINTOSH, Bruce Joseph, BSc (Hons) PhD (Cantuar). CSIRO Division of Chemical Physics, Clayton, Victoria. (Scientist)
RAM, Satyendra Parshu, BSc. Dip.Sci. PhD (Otago). NZ Pharmaceuticals Ltd, Palmerston North
READMAN, Jennifer Mary, BSc (Hons) PhD (Cantuar). University of Bristol. (Post Doc Research Assistant)
SUTTON, Kevin Howard, BSc (Hons) PhD (Cantuar). Dyson Perrins Laboratory, University of Oxford. (Post Doc Fellow).

Associate Member: EATON, Antony Clifford, NZCS. Chemistry Divn, DSIR, Auckland. (Technician).

Graduate Member: NICHOLLS, Geoffrey Malcolm, BSc (Hons Well). Expandite NZ Ltd, Wellington (Development Chemist)
ONG, Michael Kee Saik, MSc (Auck). Pfizer Laboratories Ltd, Wiri (Quality Assurance Chemist)
QUAYE, Geoffrey Walter, BSc (Hons Cantuar). Mobil Oil NZ Ltd, Wellington. (Chemist)
TAN, Johannus Kiem Han, BSc. Medic DDS Ltd, Hamilton. (Technical Rep)
VALLABH, Dilip Kumar, BSc (Hons) (RSA). 1A Orakau Ave, Auckland. (Unemployed).

Death: I. A. Rowland, (Canterbury).

Resignations: T. R. Johnson, (Wellington); L. B. Nicholls, (Waik), C. M. Jickes (Waik).

Life Member: D. H. Andrew, (Waikato); W. E. Dasent, J. N. Smith, (Wgtn); A. U. McCurdy, A. H. Wooff, (Canty); A. Macdonald, (Auckland).

ANNUAL REVIEWS INC.

Information has been received by the Registrar on prices and availability of the 1986 review publications from Annual Reviews Inc. of California. Subjects covered include Biochemistry (vol. 55), Biophysics & Biophysical Chemistry (vol. 15), Cell Biology (vol. 2), Earth & Planetary Sciences (vol. 14), Energy (vol. 11), Nutrition (vol. 6), Pharmacology & Toxicology (vol. 26), and Physical Chemistry (vol. 37). All of these and a range of other titles, including previous volumes, are available at a 30% discount through the NZIC. For further details contact the Registrar.

GOVERNMENT DEPARTMENTS & RESEARCH INSTITUTES

DSIR

Ian Rowland, Scientist in the Water Section, Chemistry Division, Christchurch, was drowned in a canoeing accident on the Ashley River on Sunday, 29 September.

Ian was a graduate in environmental science and soil science from the Universities of Swansea and Aberdeen. After a period as a PEP in the Department of Soil Science, Lincoln College, he joined Chemistry Division, Christchurch's Water Section in February this year. He was re-establishing the Chemaqua collaborative water analytical programme and was closely associated with the research programme on the effects of the metropolitan refuse disposal scheme on the Christchurch underground water system. He was active in many ways in the community particularly in orienteering. He will be sadly missed by his scientific colleagues in New Zealand, particularly at Ilam Research Centre, and the Department of Soil Science, Lincoln.

Chemistry Division, Christchurch

Mr Robert Martyn is working with the branch on a 6-month temporary position, from the University of Canterbury.

Applied Biochemistry Division.

The Biochemical Processing Centre of Applied Biochemistry Division will be hosting two two-day conferences in February, 1986. The two themes for the "New Developments in Biochemical Processing" meeting (11-12 Feb.) will be "Plant Products" and "New Methods and Techniques for Biochemical Processing". Other topics to be covered include the commercial aspects of protein separation; patenting, licensing and intellectual property; and financing and support for a new industry. "Prospects for Biochemical Production from Cultured Plant Cells" (13-14 Feb.) is a workshop examining the current state and prospects for using cultured plant cells in biochemical production. The workshop will take the form of invited plenary papers with opportunity for presentation of shorter offered papers and discussions. Four principal topics will be addressed:

1. Review of the commercial potential of plant cell culture for biochemical production and transformation; Present and future.
2. Plant cell culture; Methods and technology.
3. Switching on genes in plant cell cultures.
4. Genetic manipulation of plant cells.

For further information concerning these meetings, contact **Mrs Jenni Burrows,** Applied Biochemistry Division, DSIR, Private Bag, Palmerston North.

Wheat Research Institute

Dr Nigel Larsen attended the 35th Conference of the Cereal Division of the RACI in September and presented a paper on "Liquid Quality Factors in NZ Wheats". While in Australia, he also visited The Bread Research Institute and the Wheat Research Unit, North Ryde.

NZ Agricultural Engineering Institute

Mr Alex Drysdale will be attending the 5th International Symposium on Agricultural Wastes in Chicago in December to present a paper on "Land Disposal of Beet Ethanol Waste". While in the U.S. he will also be visiting engineering faculties in Colorado, Nebraska, Iowa and Pennsylvania.

M.A.F.

At the M.A.F.'s Invermay Agricultural Research Centre, **Dr. Tad Jacyna,** who has been working with Botany Division for the last 5 years, is studying high density fruit tree planting at Alexandra. He has succeeded in remodelling the hormone structure of stone fruit trees with the hormone paclodutrazol, an I.C.I product, so as to induce high density branching. Trials will continue for a further 3 years in order to check for detrimental effects. Stone fruits are an important export item for New Zealand.

Also at Invermay, several groups from Research Division and some associated sections moved to new premises in Puddly Alley in September. Groups which have moved include Field Research and Agronomy, the Regional Information Centre, Soil Chemistry Section, Entomology and Administration. Other sections such as Animal Health expect to remain in the old buildings for a further 18 months.

UNIVERSITIES & TECHNICAL INSTITUTES

Auckland

Professor R. C. Cambie visited Indonesia during the week of 21st October to attend the 9th Co-ordinating Board meeting of the UNESCO Regional Network for the Chemistry of Natural Products in Southeast Asia. After 10 years as the representative of the National Point of Contact of the Network Professor Cambie is stepping down from the position. His successor will be **Dr Graeme Russell,** of the Applied Biochemistry Division, DSIR, Palmerston North.

Dr R. F. Howe spent one week at CSIRO Division of Materials Science in Melbourne, carrying out ESCA measurements on catalyst samples. Dr Howe and **Dr B. A. Grigor** attended the International Coal Science Conference held in Sydney.

Dr S. J. de Mora recently attended a NATO Advanced Study Institute on The Role of Air/Sea Exchange in Geochemical Cycling, held in Bombannes (France). He also visited the Universities of Lancaster and Essex. Having eaten well, and spent time sampling the French beaches (with their accompanying delights), Steve feels he is now adequately prepared for his southern summer sojourn — in Antarctica.

Canterbury

Dr Bryce E. Williamson, who is at present a postdoctoral research associate at the University of Virginia, has been appointed a lecturer in chemistry and expects to take up the appointment in February.

Dr Williamson, aged 27, is a first class honours graduate of Victoria University, Wellington, who went on to the Research School of Chemistry on an Australian National University scholarship to complete a Ph.D. in physical chemistry last year. His research was in the field of solid state spectroscopy and he pursued this interest at Virginia. His current interests are primarily in optical spectroscopy and he has published six papers, with a further six submitted for publication.

Dr Williamson, who is married with one child, is a keen sportsman and at Virginia has been captain of the university rugby team.

Professor Richard Luibrand, on leave from California State University, Hayward, will be spending seven months in the chemistry department undertaking research in association with **Drs Murray Munro** and **John Blunt.**

Dr S. S. Tandon of the Punjabi University, Patiala, India, has accepted an offer of a three year postdoctoral appointment and will commence about the middle of 1986. Dr Tandon's research interests are in bio-inorganic chemistry and he will work mainly in association with **Dr Vicki McKee.**

Christchurch Polytechnic

In September, **David Lewthwaite** spent three weeks refresher leave at New Zealand Aluminium Smelters at Tiwai Point. While there he undertook development work related to the analysis of chloride in cryolite using a specific chloride electrode. He also took the opportunity to become reacquainted with analytical procedures used for quality control, particularly the use made of X-ray fluorescence and diffraction techniques.

Job opportunities for chemistry technicians in the Canterbury area are healthy at present with a record number of students completing Stage 5 papers towards N.Z.C.S. (Chemistry) at Christchurch Polytechnic this year. For the first time in some years, the Industrial Chemistry option at this level is being offered with the assistance of the Department of Chemical and Process Engineering, University of Canterbury.

Otago

From the Department of Chemistry, **Prof. Arthur D. Campbell** returned from an IUPAC Council meeting in Lyon to announce that he has been re-elected to the Bureau of the IUPAC for a further period of four years. He also announced that an order has now been placed for a Varian VXL300 N.M.R. spectrometer, a 300 MHz machine, for the Department. **Assoc. Prof. Jim Simpson** visited several universities in the U.K. in September after presenting a paper at the Symposium on Electrochemistry and Electron Transfer in Organic and Bioinorganic Chemistry at the 30th International Congress of Pure and Applied Chemistry in Manchester. **Dr R. M. Carr** attended the Coal

University News Continued

Research Conference in Wellington in October. This was an international conference organised jointly by the Coal Research Association, the Combustion Institute and the N.Z. Clean Air Society, and was attended by visitors from Australia, the U.K., West Germany and the U.S.A.

Assoc. **Prof. David V. Fenby** will be on leave for most of 1986. He is the only New Zealander to have been elected to a Fellowship by the Institute of Advanced Studies in the Humanities at the University of Edinburgh. This will enable him to take part in Institute Project Scottish Enlightenment 1986 during which he will be investigating the work of Scottish chemists during what is now known as the Scottish Enlightenment, i.e. the early days of the development of thermodynamics. He also plans to work in Glasgow and elsewhere during his absence. **Prof. B. H. Robinson** will be on leave in January. He will present a paper at the conference — Inorganic Chemistry Australia 86.

Miss Margo Gaudin, who worked until recently with Prof. D. A. Buckingham, has now completed her M.Sc. and is working at the Central Shell Laboratories in Lower Hutt. **Dr Alison Downard,** who has been working as a postdoctoral fellow in Southampton, will move in November to another postdoctoral position with **Prof. Tom Meyer** at the University of North Carolina.

From the Department of Botany, **Dr Paula Jameson** has attended two conferences in Europe. She presented a paper at the 5th International Conference on Plant Growth Substances in Heidelberg, and also at the 5th International Symposium on Growth Regulators in Fruit Production held in Rimini, Italy. During her absence, she also visited Michigan State University and the Beltsville Agricultural Centre in the U.S.A., and the Plant Breeding Institute, Long Ashton Research Station and Maxicrop International in the U.K. She has also been elected to a two-year term as President of the N.Z. Society of Plant Physiologists.

A grant from the Textile Education Trust has enabled a scientific officer to be employed to assist **Dr Peter Barber** from the Textiles Department with his research on Phormium tenax (flax) fibres. In this connection also, **Megan Tirose,** a masters student, is completing an investigation of hydrolytic and thermal stability of fibres prepared by traditional Maori methods. These studies, aimed at the preservation of cultural artifacts, have the support of the National Museum. **Dr Ian Weatherall,** also from Home Science's Textiles Department, attended the Textiles Institute conference at which he chaired a session on synthetic fibres.

Three people from the Department of Pharmacology, **Assoc. Prof. J. G. Blackman,** and **Emeritus Professors F. M. Fastier and E. G. McQueen,** contributed to a meeting of the Industrial Pharmacists Group of the Pharmaceutical Society of N.Z. held recently in Dunedin. Their topics were respectively, (i) Assessment of clinical trials in N.Z., (ii) Drug regulations in N.Z. and (iii) Lessons from post-marketing surveillance.

The Hospital Pharmacy Association of N.Z. also held its annual meeting in Dunedin in October. Several papers were presented there by students from the Pharmacy Department for which staff members **Dr T. Hung** and **Mr W. H. Thomas** were responsible. Also from the Department of Pharmacy, **Mr Dean Martin** will be returning to Adelaide in January after spending 12 months here during which he initiated a course on drug information.

BRANCH NEWS

Auckland

The Auckland branch ran an information service seminar at the Fletcher Challenge Library on 29 October. Those attending were addressed by **Ray Ashcroft** of ACTIS, on how the ACTIS organisation works and what it can do for customers. This was followed by **Katherine Dunlop** of Fisher & Paykel, describing the New Zealand Bibliographical Network. NZBN was then demonstrated with a search for books on various topics that the audience suggested. After coffee there was a talk by **Sue Watson** and **Janet Copsey** of Infospecs, who explained how private information brokers can access information and review literature on a wide variety of topics. Finally the meeting was shown how the Lockheed Dialog system works by **Sue Cooper** of the Fletcher Challenge information service. Topics as diverse as titanium dioxide manufacture, peat mining, and avocado production were used as examples of the types of information which can be accessed through the system. Facilities were made available by Fletcher Challenge, and hardware was loaned by Telecom Sales.

The annual Branch dinner was held early in November, at the August Moon restaurant. Fifty-three people attended the completely informal gathering. Those who could not manage with chopsticks were allowed forks so no one went hungry. The only speaker was the chairman, **Dr Bill Denny,** who welcomed the throng and guaranteed there would be no further speakers. This was followed by dancing and the limbo prize went to **Rolf Huber** of Quikstik. A very enjoyable evening was had by all.

The Polymer Group in Auckland has completed a very successful series of lectures on Adhesives Technology. The course was run at the Auckland Teachers College in Epsom over a six week period, with two speakers each session.

Although many speakers were from outside Auckland, including one from Rohm & Haas in Melbourne, the course structure did not allow for participation of industrial sectors from other parts of the country. This problem will be overcome by a block course on the same topic which is planned for 1986.

Manawatu

Dr Dave Newstead of the N.Z. Dairy Research Institute is our Branch Chairman for the coming year. Other office holders elected at the AGM on 16 October include **Dr Alastair McGibbon** (secretary), and **Dr Julian Lee** (treasurer).

In his Chairman's Address, to the AGM, entitled "Some Aspects of Lipid Investigations Carried Out Over The Past Five Years" the outgoing chairman, **Mr Denis Body,** gave a most interesting presentation of his recent research, much of which cannot be readily repeated because of the scarcity of sample material. This was especially true for his analyses of samples from endangered species such as the tuatara, takahe, kakapo and cassowary eggs. Mr Body also discussed controversies surrounding the food value of the deep-sea fish orange roughy, an important export item for New Zealand, as well as the identification of unusual minor lipid constituents of rumen liquor.

The Branch Prize to the Taranaki Science Fair was awarded to **Rachael Freidich, Joanne Leahy** and **Natarsha Kenny** for their entry entitled "The Periodic Table". A Merit Award was presented to **Nigel Rex, Mark Billinghurst** and **Paul Bayley** for their entry "A Spectrophotometer".

Canterbury

In September, **Dr Norman Clark** of NZ Steel spoke to the branch on progress towards an integrated steel works. In October **Dr Terry Seward,** Chemistry Division, DSIR, addressed the branch on gold chemistry.

The branch ran an analytical competition for schools again this year with a prize of $100 worth of goods being donated by Kempthorne Medical Supplies. This year the analyte was potassium iodate which was prepared and standardised by Chemistry Division, DSIR. The winners (again) were **Roger Vreugdenhill** and **Chris Jansen** of Middleton Grange School, Christchurch.

Otago

There were two meetings of the Branch in September. The first was held in conjunction with the University Chemistry Department at which **Assoc. Prof. D. H. Napper** from the University of Sydney spoke on "The effects of polymers on the stability of colloidal dispersions". Assoc. **Prof. D. V. Fenby** lectured on the 12th September. His talk was entitled, "The origins of thermodynamics — the Scottish contribution". In it, he traced the emergence of Chemistry as a branch of science during the Industrial Revolution of the 18th Century, which in turn was due particularly to the co-development of thermodynamics and heat engines.

The Annual General Meeting of the Branch was held on 10th October during which **Dr Ian Weatherall,** from the Textiles Department of the University, was elected Chairperson for 1986. Also, since some members have recently expressed concern about the cost and benefits of membership of the Institute, the incoming committee was charged at this meeting with the responsibility of seeking new initiatives for promoting both the Institute and the discipline of Chemistry and its related sciences. Following the formal business of the evening, the outgoing Chairman, **Mr Bill Thomson** from McLeod Bros., soap manufacturers in Dunedin, presented the Chairman's Address which he entitled, "Perfumes past and present — or, a rose by any other name".

PEOPLE

Les Boulton, formerly a scientist with AIDD, has recently joined W. Grayson & Associates Ltd, as a Senior Consultant. In his new position Les will be offering an industrial corrosion service in its widest sense, including consulting work, failure analysis, product testing, and full chemical analyses for metals, alloys and plastics.

On the Schools scene, **Mr Michael Macmillan,** a chemistry graduate from Canterbury University, has been appointed Rector of Otago Boys High School. And in the Canterbury region, **Tom Moyle** has taken up a position with D.H. Brown, and **Gary Monk** has moved to Canterbury Frozen Meats.

Still further south, **Mike Crump,** Laboratory Manager with the Southland Catchment Board, will be moving shortly to D.S.I.R.'s Geothermal Section at Taupo. **Graham McKenzie** will replace him as Laboratory Manager in Invercargill.

FROM THE RETORT

EMPLOYERS CONVICTED OF MURDER

Some might say it could only happen in the USA. In June of this year three former executives of Film Recovery Systems Inc. were convicted of murder in the State of Illinois, and sentenced to 25 years in prison, for the job-related death of a former employee.

The death occurred as the result of cyanide poisoning in a silver recovery plant operated by the company in a suburb of Chicago. Prosecution was based on the contention that the death resulted from acts of commission and omission which created a strong probability of death or bodily harm. Specifically, it was charged that: the employers failed to disclose to the worker who died that he was using cyanide in his work and that this was dangerous; they failed to instruct him on safety procedures and proper handling of the chemicals; they failed to provide him with appropriate and necessary safety and first-aid equipment and health monitoring; they failed to provide for the proper storage, detoxification and disposal of the cyanide.

In the same state another investigation is also under way into the possibility of criminal charges arising out of the death from silicosis of a former employee of the Illinois Brick Company. Eleven other former employees of the plant out of a workforce of 30 have contracted silicosis, and two of these have died of the disease.

In this country the Labour Department has successfully prosecuted companies in the past for failing to take remedial action for hazardous situations in the workplace. The resulting fines have been paltry by comparison with the above, and have not been directed at individual executives. It seems unlikely that we would ever see such extreme action being taken here — as we all know the Yanks are inclined to go overboard on anything involving "chemicals". Nonetheless, the item certainly should provide food for thought, in both employer and employee organisations.

ARE THERE ANY LEFT?

We aren't quite sure whether or not chemists can be numbered amongst those groups of professionals who continue to have a higher than average consumption of cigarettes. Surely not after all those warnings? However, if there are some smokers still out there stand by for another nail in the coffin!

Cigarette smoking is a major risk factor in premature stroke according to the findings of the Auckland Stroke Study. Stroke is the third leading cause of death in New Zealand, after coronary heart disease and cancer, and is an important cause of long-term disability.

Funded by the Medical Research Council and the National Heart Foundation, the Auckland Stroke Study is the first in New Zealand to have established the occurrence and incidence of stroke. An important finding of the study is the strong association between cigarette smoking and the increased risk of stroke in the 35-64 age group. According to principal researcher, Dr Ruth Bonita of the Auckland Medical School, approximately 37 per cent of strokes in the study may be attributed to smoking and 36 per cent to hypertension in this age group. "Furthermore, those who both smoked and had hypertension were almost twenty times more likely to suffer a stroke than those who did not."

FINALLY

Feeling tired, listless, run-down? Chances are you may be suffering from work-related stress. If you're one of those people who have started to worry about your personal culpability for workplace disasters; or you're being run off your feet by demands to analyse fifty bottles of wine and have the results by yesterday; or perhaps you're beginning to feel that university life just ain't what it used to be . . . Whatever your situation you will definitely be interested in the results of a survey by the University of Manchester into the relative stress levels of a variety of jobs. The results published recently in Occupational Safety and Health give a rating on a scale of 0 to 10, with the highest values indicating the greatest stress. At the top of the list are miners (8.3), police (7.7), construction workers (7.5), and journalists (7.5). Teachers are rated at 6.2. Bottom of the list are librarians (2.0), although I know some who would strongly deny that. Laboratory technicians also get a low rating of 3.8 thereby proving what easy lives they really do have. Unfortunately chemists don't get a mention, and we are therefore left to conclude that their rating must have been way off-scale!

Unniloctium.

SAFETY PRODUCTS

FIRST AID AVAILABLE TO ALL

July 1, 1985 marked a change in the law relating to safety in the workplace. From that date virtually all factories and commercial premises were required to have a first aid kit on hand.

NZ Safety's first aid kits are all specially packed according to the new regulations, which require that such premises have first aid supplies to ensure that any person injured within them can receive adequate treatment without delay.

Four different sizes of commercial first aid kits are sold by NZ Safety, to provide supplies for five or fewer employees, 6 to 25, 26 to 50 and 51 and over. Each contains bandages, scissors, pads, safety handbook, eye drops, gauze, disinfectant, dressing strips and other materials.

The new requirements, called the Factories and Commercial Premises (First Aid) Regulations 1985, state that where from five to 49 people are generally employed, one person is to be in charge of all first aid supplies, cabinets and rooms, but where shifts are worked there is to be one person per shift.

In undertakings with 50 to 99 people employed, a trained person must be in charge. This person may be a registered nurse or the holder of a current first aid certificate issued by the St John Ambulance Association or the Red Cross. A first aid room is to be provided where more than 100 people are employed.

First aid kits are also available from NZ Safety for use in the home, car, schools, hotels, boats and other areas. Special kits can be made up to suit particular requirements. NZ Safety can also advise on first aid training schemes available in your region.

The first aid kits will be available from all NZ Safety's retail outlets, along with a wide range of other safety equipment if desired. For further information circle 1 on the reader reply card.

RUGGED EXTRACTION FAN YIELDS HIGH STATIC PRESSURE

Noxious fumes and dust particles are removed efficiently from the workplace by a heavy duty fan which can eliminate the need for costly permanent ventilation systems.

Already extensively proven in factories, construction sites and vehicle workshops, this "Porta-Vent" fan develops a high static pressure sufficient to feed the exhaust through a long flexible duct if required (see illustration).

Typical applications include removing adhesive solvent and paint fumes, welding fumes, engine exhaust gases, chemical sprays, wood sanding dust and grinding grit. The device has successfully vented confined spaces such as tanks, ships' bilges, under-roof voids and cramped factory work-stations.

Manufacturers A. & T. Burt Mechanical Ltd., designed the fan for continuous running under rugged conditions. The heavy duty, single phase motor has a built-in overload and drives a moulded aluminium impeller. The casing is also cast in aluminium and the whole fan is purposely built with as few parts as possible. Accessories include hose, clips and extractor nozzles.

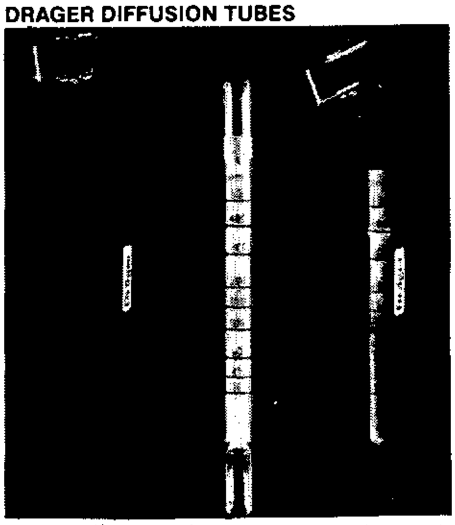
Price is minimised by batch manufacture.

A technical advisory service can check the fan's suitability for all sites including those involving inflammable fumes.

Ex-stock supply is available and enquiries are welcomed from interested retail outlets.

For further information contact: Peter Hockley, A. & T. Burt Mechanical Ltd., Product Division, tel: (03) 795-355, P.O. Box 2944, Christchurch; or circle 2 on the reader reply card.

DRAGER DIFFUSION TUBES



Now air contaminants can be easily monitored in the workplace, with a new type of diffusion tube from Drager. In introducing this new system, Drager has perfected the passive method of "on-the-spot" sampling.

This system is primarly designed for measuring the personal exposure either over a complete shift — or shorter periods.

The system comprises various diffusion tubes assigned to the individual measuring purpose, along with a re-usable holder.

The diffusion tube is inserted into its holder and broken off at the given bead. The completed system is then clipped to the work clothes.

Now mark the starting time on the white label and proceed with pollutant measurement.

The system is worn by the user for the desired period and, by diffusion, it automatically takes samples of contaminants from the ambient air. The presence of pollutants is recognised by specific discolouration in the tube and the lengthening of this discolouration.

Note down completion of measurement and read off scale value (discoloured area). The average value of pollutant concentration can be easily calculated.

Tubes are available for the following gases: Acetic acid, Ammonia, Carbon dioxide, Carbon monoxide, Hydrochloric acid, Hydrocyanic acid, Hydrogen sulfide, Nitrogen dioxide, Sulphur dioxide.

For further details. contact NZ Safety Ltd, Auckland, or circle 3 on the reader reply card.

NEW SAFETY BULB FROM BIOTEK

The Safety Bulb II provides the necessary suction to fill standard glass and plastic pipettes. It eliminates mouth pipetting with all of its hazards from burns, disease, and poisoning.

To Use the Safety Bulb: Just squeeze the bulb, touch it to the back of the pipette and draw up the fluid. Take the bulb away and control the fluid level with your index finger, just like you always do. With the Safety Bulb you just touch it against the back of the pipette to bring it into action. No more stuffing, cramming and fitting your pipette to the filler. Pipetting is natural with the Safety Bulb. You don't change your technique. You still control the flow with your finger, but you keep the pipette away from your mouth. The Safety Bulb is good for small sample pipettes thru the largest volumetrics. It may be autoclaved, opened and cleaned whenever necessary.

One Size Fits All: The soft neoprene rubber tip seals to the end of each pipette with just a touch. Easy to use. Good for small sample pipettes thru the largest volumetrics.

For further information contact Biotek, Auckland, or circle on the reader reply card.

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use its fruits. The market must therefore influence, by frequent review the research and development or innovation taking place. The next questions which arise are: Where should it take place? Who should pay for it? If these activities should take place when a need for them has been clearly perceived and established then resources have to be made available if the investor believes that the market will respond sufficiently to them to use the results.

This will foster most where a keen entrepreneurial spirit exists — whether in some company, single inventor, or a government trading department, or a department responsible for servicing a policy. There is no room in New Zealand for research outside such areas.

5. **Research and development should take place in discrete, project orientated, "centres of excellence" close to, or in conjunction with, necessary servicing resources.**

Outstanding examples in New Zealand of this principle are the Energy Research and Development Committee, the Liquid Fuels Trust Board, Research Associations, Planning Council and some research units within Universities. Overseas examples include the very close relationship which many Universities have with their surrounding commercial, agricultural, industrial, medical sectors. These examples are well known and it is encouraging to see that this trend is being fostered in most of New Zealand's research establishments.

Investment in these activities requires courageous far sightedness and, in the economic situation New Zealand now finds itself, the following of these principles should lead to an increased national wealth through new products, systems, services and knowledge.

J. G. Fletcher, FNZIC, Comp IPENZ, Director NZ Heavy Engineering Research Association Inc.


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Product Feature:
CENTRIFUGATION — THE BASICS

Centrifugation — The Basics

The following notes have been extracted from Centrifugation — A Practical Approach (Ed. D. Rickwood, 1984). This 350 page paperback is provided free to all purchasers of Kontron centrifuges, and contains much useful information for both the novice, and the experienced user of centrifuges.

Types of Centrifuge

Centrifuges can be classified on the basis of a variety of criteria. However, perhaps the most useful approach is to classify preparative centrifuges on the basis of their maximum speed since this gives an indication of the centrifugal force that can be generated and, in turn, their range of applications.

Table 1 gives the three main classes of centrifuge, namely, low-speed, high-speed and ultracentrifuge, together with the usual range of applications of each type of machine.

Low-speed Centrifuges

These machines range from small bench centrifuges, in which the samples are kept cool by drawing air through the centrifuge bowl, to the large refrigerated floor-standing machines capable of centrifuging up to 6 litres at a time. These machines are used routinely for the initial processing of biological samples. This type of centrifuge can be used for pelleting cells and the faster sedimenting cell organelles such as nuclei and chloroplasts. In addition, they can also be used for the fractionation of cells either on density gradients or by centrifugal elutriation.

High-speed centrifuges

These centrifuges, usually with maximum speeds of 18,000-25,000 r.p.m., are machines that can generate about 60,000g, they are much cheaper to buy and maintain as compared with ultracentrifuges. High-speed centrifuges are refrigerated and some types also have a vacuum system. However, machines with a vacuum system are usually less convenient to use and more expensive to maintain but they do have the advantage that they have more accurate temperature control systems although, for most practical purposes, this may not be important.

These machines, like the low-speed centrifuges, are used mainly for the preparation of subcellular fractions. The advent of vertical rotors has facilitated the use of high-speed centrifuges for gradient separations.

Ultracentrifuges

These can be subdivided into two types, analytical and preparative ultracentrifuges; the former are primarily designed to obtain very accurate data on the sedimentation properties of particles. Preparative ultracentrifuges are also widely used for quantitative estimations of sedimentation coefficients of particles in sucrose gradients although, using preparative rotors, the data obtained is not as accurate as that obtained using analytical ultracentrifuges. Some types of preparative ultracentrifuge do have attachments allowing analytical rotors to be used but the quality of the optical system is not usually as good as that of dedicated analytical centrifuges.

The centrifugal force generated by ultracentrifuges can be significantly greater than 600,000g which is sufficient to pellet even quite small proteins.

Drive Systems of Centrifuges

Electric Motor Systems

This method is the commonest method used for the manufacture of all types of centrifuge. However, there are a number of very different electric motor systems which vary according to the type of centrifuge. The two commonest forms of motor used are the d.c. brush motor and the induction motor which are used for a wide range of centrifuges. Brushless induction motors tend to require less maintenance although they do require more complex cooling systems, central circuitry and a higher electrical current.

The motors may either drive the rotor directly (direct drive) or indirectly via a belt drive or a gearbox. The direct drive systems tend to be more reliable in that there are fewer components which can fail. On the other hand, direct drives involve greater stresses on the motor assembly, particularly in the case of the high speed and ultracentrifuges where speeds are higher and the precision of the components must be much greater.

Turbine Drives

The advantage of this system is that only the small turbine assembly and bearing housing are subjected to high stresses and this tends to enhance the overall reliability of the system. It is also claimed that the acceleration control of this system is superior in terms of gentle acceleration at low speeds. However, there is no evidence that, in practice, this system will give better results. The other problem is that the relatively low torque of the turbine limits the acceleration rate of the heavier rotors.

Table 1. Types of Centrifuges and Their Applications.

	Type of centrifuge		
	low-speed	high-speed	ultracentrifuge
Speed range (r.p.m. x 10^{-3})	2-6	18-25	40-80
Maximum RCF (g x 10^{-3})	6	60	600
Refrigeration	some	yes	yes
Vacuum system	none	some	yes
Acceleration/braking controls	some	variable	variable
Applications for pelleting:			
cells:	yes	yes	yes
nuclei	yes	yes	yes
membranous organelles	some	yes	yes
membrane fractions	some	some	yes
ribosomes/polysomes	—	—	yes
macromolecules	—	—	yes

Centrifuge Rotors

Originally rotors were designed in a fairly empirical manner in which, having chosen the capacity of the rotor, a round piece of metal of the appropriate size which was strong enough to reach the required speed without disintegrating was used. However, the use of computer-aided design methods has resulted in the development of rotors with more angular appearances. This is because any metal that does not directly strengthen the rotor weakens it because of the centrifugal forces that act on the rotor when it spins; indeed most of the strength of the rotor is required to hold the rotor together rather than to retain the sample tubes within the rotor.

Materials Used in the Manufacture of Rotors

The stress on rotors is related to the square of the speed and hence the stress experienced by ultracentrifuge rotors is very much greater than in the case of low-speed rotors. Rotor components of low-speed centrifuges can be made of brass, steel and even plastics, although some more advanced low-speed rotors use stronger, lighter aluminium alloys which enhance the performance of rotors. For high-speed and ultracentrifuge rotors either aluminium or titanium alloys are used. The exact alloy used will depend on the required performance of the rotor.

All rotors made from aluminium alloys must be treated with extreme care since they are particularly susceptible to corrosion. Aluminium rotors are usually anodised but this does not give a high degree of protection against corrosion. When aluminium rotors are centrifuged at high speed the protective oxide film is disrupted allowing further corrosion of the metal within the body of the rotor; this is known as stress corrosion. In addition, aluminium rotors suffer from metal fatigue.

Titanium rotors are much more resistant to corrosion and indeed corrosion is unlikely to present problems using any of the solutions normally used for the separation of biological material since titanium is resistant to salt solutions at both acid and alkaline pH. In addition, titanium rotors do not suffer from metal fatigue and they are also resistant to stress corrosion.

Centrifuge Tubes, Bottles and Caps

A wide variety of materials have been used for the manufacture of tubes and bottles for centrifuges. It is important to be aware of the limitations of each material since these affect their applications.

The correct choice of tubes is important in order to facilitate centrifugal separations. The choice of tubes dépends on several factors including the type of rotor used, nature and volume of the sample as well as the method used to fractionate the solution in the tube after centrifugation.

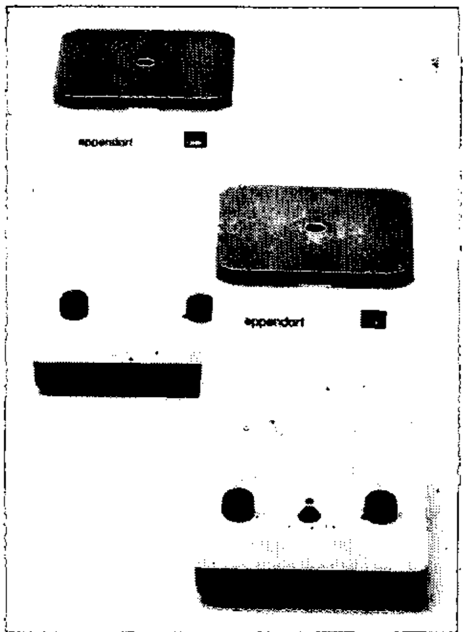
CENTRIFUGES

Some time ago we had in our laboratory a hand-driven centrifuge. If you cranked really hard you could probably get it up to 100 rpm, and if you had the stamina you would probably maintain that for five minutes or so. I'm not sure if it was ever used in earnest. It was certainly bottom of the line as far as todays range of centrifuges is concerned. For a sampling of just what is available, consider the offerings below and on the next pages, from some local suppliers.

Bruce Graham

Eppendorf 5413, 5414

The Eppendorf Centrifuges are ideal for separating fluids whose components have varying specific densities. The rapid centrifugal acceleration dramatically shortens running time, which makes these centrifuges highly efficient. There are many applications for centrifuges in clinical and biochemical labs, such as serum separation and separating precipitates following deproteinization.



The centrifuges are compact and require a minimum of space. The noise level has been reduced to a minimum. The timer may be set to run up to 15 min. The electronic braking circuit slows the rotor rapidly, so time is not wasted waiting for the centrifuge to stop.

All centrifuges feature a magnetic latch for improved safety which prevents starting the centrifuge with the lid open as well as preventing opening of the lid before the centrifuge has stopped.

Centrifuges 5414, 5414S

For electrical requirements of 220V two models are available: 5414S is best suited for research applications with 15,600G at 15,000 rpm and 5414 for manual sample handling in routine applications with 9,980G at 12,000 rpm.

The Centrifuges 5414 and 5414S accept up to 12 Micro Test Tubes (1.5 ml) at one time in their angled rotor. The positions are numbered from 1-12 to insure against confusion when transferring the test tubes to and from the centrifuges.

In addition to the regular timer for up to 15 min., the centrifuges also feature a momentary switch for centrifugation times under one minute. Pressing the button starts the centrifuges, releasing it stops the centrifuges. A pilot lamp blinks once each second when the button is depressed, so the time can be easily determined in seconds for accurate reproducibility.

Adapters are available for centrifuging small volumes in 0.4 ml test tubes.

Centrifuge 5413

Because of its larger capacity, the Centrifuge 5413 is ideal for sample preparation in automated procedures. The 4 compartments of the rotor each accommodate a chain link section of 8 test tubes (4 x 8 = 32). Micro test tubes may also be centrifuged in test tube carriers, each accommodating 10 test tubes (4 x 10 = 40).

For further details contact Kempthorne Medical Supplies, or circle on the reader reply card.

MSE Centaur 2

The new Centaur 2 is the latest remarkable advance in bench-top centrifuges from MSE.

Bringing together the superb advantages of versatility, efficiency and safety which established Centaur 1 as the leading bench-top centrifuge, Centaur 2 really excels itself in terms of ease of operation and accuracy.

Centaur 2 incorporates a host of safety features that have been developed to meet the highest safety standards: including a 5 mm thick guard ring, a four-point burst-proof lid fixing, a lid interlock which prevents access to the moving rotor, bolt down security and an out of balance detector.

Centaur 2 is extremely versatile. With a wide accessory range including 2 angle and 3 swing out rotors, Centaur 2 can also accommodate most existing Minor and Minor 'S' rotors.

Centaur 2's stop/start switch means that there is no need to reset the speed between runs, the 0 to 30 minute timer enables runs to be accurately reproduced.

A wide removable bowl facilitates both easy access and cleaning.

When MSE first introduced Centaur 1 it was acknowledged as a major advance in centrifuge production.

The development of Centaur 2 with even higher standards of accuracy and ease-of-use will further establish the Centaur as one of the world's leading bench-top centrifuges.

Features

★ Range of sealed containers.
★ Imbalance detector.
★ Lid interlock.
★ Four-point lid fixing.
★ 5 mm thick guarding.
★ Bolt down facility.
★ Digital speed indication.
★ Fully automatic dynamic braking.
★ Accepts most Minor & Minor 'S' accessories.
★ Quiet in operation.
★ Reliable.
★ Easy-to-use.

Protection from aerosols

The MSE Centaur 2 sealed bucket system ensures the safe centrifugation of blood samples and other infectious material. Thanks to the completely sealed 200 ml buckets with tightly closing transparent lids, infectious material can neither get into the centrifuge nor the surrounding area as a result of aerosol formation or glass breakage. Furthermore, glass breakage, which represents the most frequent cause of contamination or infection, can be identified immediately through the transparent polycarbonate lids so that in case of emergency the buckets have the advantage of easy transfer to an exhaust protective cabinet or autoclave.

For further details contact Kempthorne Medical Supplies, or circle on the reader reply card.

HERAEUS CHRIST

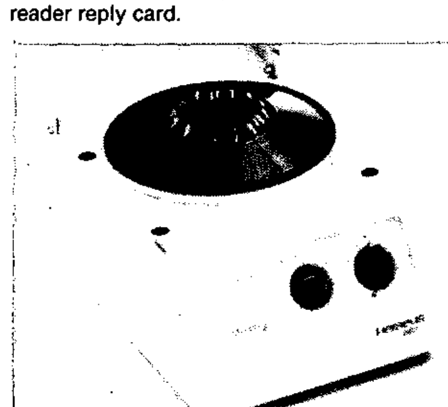
Small bench top centrifuges now have something in common with their bigger brothers. Reproducible speed control has always been a feature of large centrifuges made by Heraeus Christ. That same feature is now on four bench top centrifuges being sold in NZ. Modern electronics combined with a whisper quiet dc drive mean you get exactly the speed you set every time. Four inexpensive models cover a wide variety of tasks.

Haemofuge A is a centrifuge for the rapid determination of the cell volume of blood, according to the German Standard 58933. It is equipped with a 24-place capillary rotor, which is accelerated to a top speed of 12,000 rpm, equivalent to 14,890 x g. The control panel includes an illuminated push button for mains, a run indicator light, timer for runs up to 15 minutes, and an electro dynamic brake which comes into effect upon expiration of the preselected time.

Biofuge A is a combined microliter/Haematocrit centrifuge. Angle rotors for microtubes of different sizes — up to 40 tubes per run — can be inserted, as well as a 24-place haematocrit rotor for the determination of blood cell volume. With a top speed of 13,000 rpm the Biofuge A attains the considerable centrifugal force of 17,390 x g.

Biofuge B has — compared with Biofuge A — a considerably higher capacity. With a capacity of up to 160 microtubes the model B offers an alternative for laboratories which have to process a large number of samples every day. BIOFUGE B accommodates a drum rotor for eight interchangeable tube racks for microliter tubes of different sizes, top speed 11,000 rpm equivalent to 11,630 x g. In addition, a 24-place capillary rotor for the determination of blood cell volume can be used.

Medifuge is a small centrifuge for use in Industrial Laboratories and small hospitals, equipped with an angle rotor for accommodation of 12 tubes of 15ml. Vessels of a total length up to 131mm can be used alternatively in a sixplace rotor. A relative centrifugal force of 3030 x g is attained at top speed of 5300 rpm. For further information, contact Smith-Biolab Ltd, Scientific Products Division, Private Bag, Northcote, Auckland, or circle on the reader reply card.



Digifuge GL, Labofuge GL

Further up the scale in the Heraeus Christ range are these two bench model centrifuges:

DIGIFUGE GL — the digital centrifuge with full programmability and
LABOFUGE GL — the analog centrifuge with analog read-out

These two best sellers are equipped with improved drive systems and additional soundproofing. The suffix — "GL" has not been borrowed from the car industry as a synonym for "Grand Luxe" but stands for the new DC drive.

CENTRIFUGES

This is a "luxury" every centrifuge user can and should treat himself to, as it ensures short acceleration periods. To quote only one example: the popular sealed rotor for safe centrifugation of infectious materials affording maximum volumes of 4 x 100, 8 x 50, 20 x 25, 44 x 15, or 88 x 7ml, will be accelerated to 6000 rpm in just 85 seconds.

Further improvements are: An imbalance detector as standard equipment and a new accessory package. This includes a four-place swing-out head with rectangular buckets for accommodation of the brand new Centri-Lab system. The name "Centri-Lab" stands for a system of centrifuge tube-racks enabling laboratory scientists to perform all stages of sample processing such as sample-preparation centrifugation, decanting and incubation, easily and conveniently.

Bench top centrifuges DIGIFUGE GL and LABOFUGE GL; Top speed 6000 rpm, maximum centrifugal force 5920 xg.

For further information, contact Smith Biolab, or circle on the reader reply card.

International Equipment Company

Founded in 1901, IEC is one of the world's leading producers of laboratory centrifuges. IEC offers a complete line of systems ranging from low-cost bench units to the most advanced ultracentrifuge equipment on the market today. In addition, IEC provides a comprehensive selection of general-purpose and application-specific centrifuge accessories — accessories which rarely become obsolete because they work on other IEC models, both old and new.

IEC are represented in this country by Sci-Med. For further information circle on the reader reply card.

Two of the models in the IEC Range are the Centra-4 and Centra-8, as detailed below.

IEC — Centra-4

A bench-top general-purpose centrifuge, with wide capabilities including the following:

High Speed Microsample Capability: Accommodates all popular 0.25 to 2 ml microtubes and offers speeds to 12,000 RPM for rapid separation. Four microsample rotors are available including two with convenient sample tray inserts — up to 60 samples per run!

Microscope Slide Deposition: Accepts IEC Cytobucket™ carriers . . . a better way to deposit cells in a monolayer onto standard microscope slides. The IEC method offers higher recovery, improved morphology and over five times the starting volume of other cytocentrifugation techniques.

Microhematocrit Capability: Spins a 24 position capillary tube rotor to 10,500 RPM for fast, accurate microhematocrit determinations. Accessory microcapillary tube reader available to complete the system.

Large Batch/Volume Capability: Accommodates all standard tubes to 50 ml; bottles to 125 ml. Biohazard containment capability. Up to 48 12 x 75 mm tubes or up to 500 ml total sample volume. Hundreds of accessory combinations available, most of which are interchangeable with other IEC bench models.

The IEC CENTRA-4. It's like four centrifuges in one. Only better. Because it combines a whisper-quiet drive and advanced control features with traditional IEC reliability, safety and value. It's the logical choice for any modern clinical or research laboratory.

IEC Centra-8

Here's a centrifuge system that sets new standards for high capacity bench-top centrifugation. More power. More versatility. More accuracy. And more value.

All controls are digital for easy operation, exacting repeatability and instant verification of run conditions. Regardless of rotor used, you get smooth acceleration to set speed with no overshoot, accurate to within 10 rpm. Automatic soft start and dynamic braking protect even the most delicate density gradients.

High Speeds and Forces:

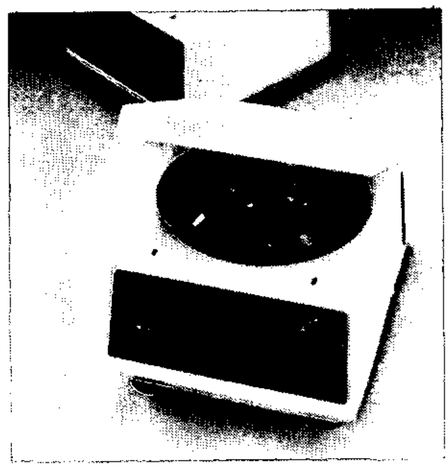
Here's a centrifuge with the power to get big workloads done fast. Yet with all its muscle, CENTRA-8 is amazingly quiet and essentially vibration-free. Maximum speed is up to 5800 rpm.

Superior Refrigeration:

CENTRA-8R's compact rear-mounted compressor and coil-wrapped refrigerated guard bowl provide unsurpassed sample temperature control . . . ± 1.0°C accuracy at any set point from 0°C to +20°C. In addition, an expanded set point range lets you handle applications requiring temperature control to +39°C.

Large Batch/Large Volume Processing:

In bench-top centrifuges, bigger is better and CENTRA-8 offers the largest capacity of them all . . . up to three times the capacity of other popular brands. With a single rotor/adapter system, you can spin four 750 ml bottles or 144 RIA tubes, and large batches of virtually every sample container in between.



Front Cover Story

The MISTRAL 3000 is the latest addition to the highly successful MSE Mistral range of centrifuges first launched in the mid 1960's. The Mistral 3000 represents a **totally new concept in bench-top refrigerated centrifugation,** offering more unique advantages for exacting laboratory work; all the new features of this centrifuge combine to give the operator faster, more accurate results.

The main 4 x 750 ml windshielded swing-out rotor is driven by a 0.5 hp brushless induction motor, a powerful unit that, until the Mistral 3000, was usually associated only with floor-standing centrifuges. Precise speed control, rapid acceleration when required and greater reliability and serviceability are among the benefits this affords.

The Mistral 3000 features a bright, digital display that allows all parameters of a given run to be accurately reproduced and easily read.

Microprocessor controls in the Mistral 3000 provide simplicity of use and other operational advantages not normally found in a bench-top centrifuge. These advantages include 'automatic brake rate control' with 10 rates of braking including 'brake off', precise speed control at low speeds and 'rotor identification'. Rotor identification allows the operator to use the 'integral' function on the control panel to obtain the 'g' value at any given time during the run.

Top speed for the Mistral 3000 is 6000 rev/min, with a maximum RCF of 6030g. In the case of the 4 x 750 ml windshielded swing-out rotor, a full 3 litre load can be run at 3660 rev/min, giving a maximum rcf of 3003g. As with all MSE centrifuges, operator safety has been a paramount consideration in the design of the instrument. The Mistral 3000, when used with its range of swing-out rotors, complies fully with the specifications of BS4402:1982.

The Mistral 3000 is British made and is backed by the Fisons Scientific Equipment Division's Service Organisation — the largest specialist servicing network in Europe.

The Mistral 3000, designed to BS4402:1982 features:-

- ★ Large rotor capacity — 4 x 750 ml
- ★ Induction drive, giving rapid acceleration and precise speed control
- ★ Digital display of all parameters
- ★ Microprocessor control
- ★ True 'coiled-bowl' refrigeration giving precise temperature control
- ★ Designed for bench-top or trolley mounted use
- ★ The Mistral 3000 accepts a wide range of rotors, sealed buckets and adaptors, including buckets from the Centaur range
- ★ 'Integral' function for instant RCF values
- ★ Windshield lid storage position
- ★ Micro-Titre plate facility

For further information contact: Scientific Division, Kempthorne Medical Supplies, P.O. Box 1234, Auckland, or circle on the reader reply card.

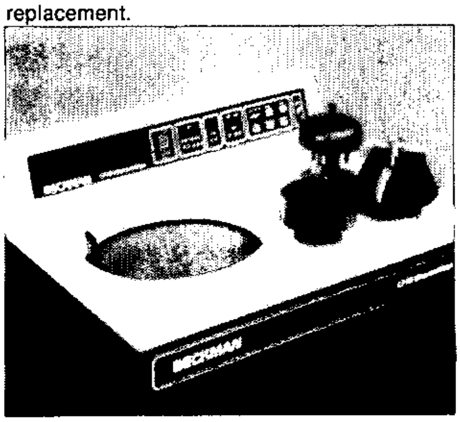
CENTRIFUGES

BECKMAN

A range of centrifuges is available from Beckman, but of current interest is the newly released L7-55 Ultracentrifuge. Imagine the world's simplest operating ultracentrifuge. Add the most reliable drive system ever designed — the Ultra-Smooth vacuum encased induction system. Include automatic 'Soft-Start', built in diagnostics and the ability to run every Beckman high performance rotor. Top it off with a most attractive purchase price and you have the Model L7-55.

With speeds to 55,000 rpm, forces to 408,000g integrated circuit logic and remarkably simple controls, the L7 is ideal for everyday applications where very high g force, sophisticated programmed control, and computer interfacing is not required.

If it's finally time to pension off your 'old-faithful' model L, the new L7-55 is the ideal replacement.



In addition to the L7-55 Beckman Instruments offer a full range of centrifuges from the highly sophisticated L8-80M with the unique vacuum enclosed induction drive system to the three Microfuges models 11, 12 and B. Then there is the analogue TJ6 and new high performance digital Accupsin bench top centrifuges. Next in line is the high capacity medium speed J6 series followed by the high speed J2-21 series. Both the J6 and J2-21 series are available with the same advanced induction drive system and microprocessor controls as the L8-80M.

Also recently released is the TL100 bench top Ultracentrifuge with all the features of quiet vacuum-enclosed induction drive, full vacuum, refrigeration and microprocessor controls that are present on the full size ultracentrifuges.

For further information contact Bren Collinson at Alphatech Systems, Auckland. Phone 770-392, or circle 4 on the reader reply card.

Kubota

Also available from Sci-Med is the Kubota range of centrifuges, including the KR-600 general-purpose refrigerated model, the KM-15200 micro-centrifuge, the KR-20,000 T high speed refrigerated model, and the KR-2000 C microprocessor-controlled high speed refrigerated unit. Features of this latter unit include the following:

Automatic setting of maximum speed, and temperature control according to rotor identification, as entered on the keyboard. Automatic calculation and display of centrifugal force or rpm after entry of either of these parameters. A built in Gt integration system, thereby removing the need to specify operating time. Up to 9 user-programmable operations with automatic retention of last operation recorded, and 9 choices of acceleration/deceleration curves.

For further information circle 5 on the reader reply card.

SAVANT

The Savant range of equipment is available through local agents, Alltech Associates NZ. Included in the range are the HSC10000 High Speed Centrifuge, and the SVC100H, and SVC200H Speed Vac Concentrator/Evaporator systems.

HSC10000

A High Speed Table Top Centrifuge including provision for cooling or heating the chamber with externally supplied temperature controlled water. Unstable biological samples can be run at high rotational speed with minimal heating effects when cold water is run through the coil of the centrifuge chamber.

Many investigators now recommend centrifuging at a constant temperature (37°C) for hormones or drugs in order to achieve reproducible and reliable data. The resulting data is more meaningful for evaluating the clinical picture.

Another big advantage is the availability of a wide range of rotors which accept a wide range of containers. The variable speed control allows one to slowly accelerate rotor to maximum speed. This will produce a tighter pellet and carry the pellet to the bottom of the tube.

Maximum speed is 10,000 rpm, and the unit is available with accessories for heating and/or cooling of the centrifuge chamber.

SVC100H

The Speed Vac Concentrator combines hi-vacuum application and rotary action for the high efficiency evaporation and volume reduction of biological solutions. During the entire process... an Internal Heater supplies heat on demand at 44°C to the vacuum chamber to increase evaporation rate approximately two-fold. The rotary action concentrates the sample "without bumping" and "without foaming" while the evaporation is progressing during the entire process. This technique makes it possible to achieve nearly 100% sample recovery.

The rotors hold up to 100 tubes or vials which are magnetically driven within a completely isolated vacuum chamber. This is the ideal device for preparing dried samples at the bottom of the container whether it be in Microcentrifuge Tubes, Culture Tubes, Tapered Tubes or Vials.

SVC200H

The Model SVC200H Speed Vac Concentrator is a larger version of the smaller model. It operates precisely on the same principle, concentrating the sample "without bumping" and "without foaming" during the evaporation process. The rotating action on the sample accelerates the concentration of the sample while the solvent phase is sublimed or evaporated off.

The Speed Vac method eliminates sputtering of the solvent and cross contamination. It is ideal for radioimmunoassay procedures where it is now widely used to achieve 100 per cent sample recovery.

The larger Model SVC200H will handle a wide variety of tubes... as many as 200 culture tubes measuring 12 x 75mm or a smaller number of large tubes or vials or flasks; e.g. 8 RECOVERY FLASKS which will hold 100ml each of solvent. In general, when large volumes are reduced by this method, the solvents are volatile, organic solvents such as ethanol, methanol, chloroform and such...

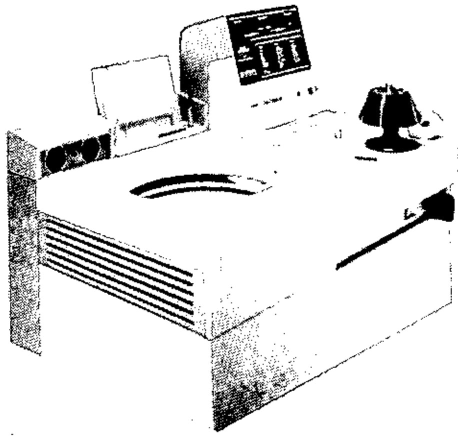
This model has been very popular in applications involving the processing of a large number of tubes as in Radioimmunoassay Analyses and Drug Screening and other similar applications . . . Note that a manifold bleeder valve is available for bleeding in nitrogen rather than air for samples that might be particularly sensitive.

For further information on these products contact Alltech, or circle 6 on the reader reply card.

Kontron Analytical

Kontron-AG are a division of Hoffman-La Roche, and represented in New Zealand by Roche Products NZ Ltd, Penrose, Auckland. A wide range of centrifuges is available from Kontron, from six high and low-speed bench-top models, with or without refrigeration through to the Centrikon T-2000 series of refrigerated ultracentrifuges, featuring up to the minute microprocessor control. Consider some of the features of the T-2000 series:

Digital drive electronics keeps the frequency controlled direct drive right on the preselected speed. The digital readout gives proof of the unmatched stability in 10 rpm increments over the whole speed range. For your special applications, you can select the right acceleration/deceleration program from 5 different power modes. For vertical rotors there's an additional super-soft program: extremely smooth acceleration up to 800 rpm results in eddy-free re-orientation giving you excellent and reproducible separations even with shallow gradients.



First class mechanical precision bearings stabilise the rotor during its passage through the low critical speeds. The dynamic imbalance control reports during the whole run in any deflection and precession of the rotor axis to the microprocessor. The optimal safety limits, dependent on the actual speed, are set automatically. Your advantage?

A wrongly-loaded rotor is rejected. If a tube begins to leak at high speed, it is detected and the run is stopped in time to prevent drive wear and spindle damage. The drive itself is mounted in a special housing to guarantee proper lubrication even when there is a power or water failure. Your run is completed by the autorestart program if power or water are restored while the rotor is still spinning. The maximum temperature, the lowest speed and the duration of the interruption are stored and you can recall these by pressing the interrupt info key.

Automatic safety features make a big contribution to functional reliability. The microprocessor keeps a steady check on the most important run and status parameters so as to guarantee trouble-free operation. The "error display" informs the user of any mistake in the preselection of run settings. For example, the **CENTRIKON T-2000** checks the rotor's overspeed disc at the start of the run to determine the highest allowed speed. If the preselected speed exceeds this, then the rotor is kept refrigerated at 3500 rpm, while an alarm tone notifies the operator. You can connect these

CENTRIFUGES

new ultracentrifuges to a central alarm monitor; an interface RS 232C allows communication at even higher levels (e.g. in biological P3 labs or for central data processing, etc.).

No more wearisome bookkeeping! The exclusive automatic logbook printer gives for each run above 6000 rpm a full parameter listing for your lab journal. After 30 runs it prints a full page for the DIN A5 ringbinder delivered with the printer. Just fill in the rev. counter reading and file it away!

The microprocessor keeps a record on the lifetime of all your rotors. With a simple code you tell the printer-equipped **CENTRIKON T-2000** models which rotor you are going to use (up to 30 rotors can be filed).

The accumulated number of runs and the total run time are checked automatically. When safety requires the rotor to be derated the microprocessor will remind you to replace the over-speed disc, and the rotor will not be accepted until this has been done. No longer do you have to work through old logbooks — one touch on the "rotors" key and you have a complete report on all your rotors and their derating and warranty status!

Convenient accessories will reduce your work-load and increase your efficiency: outlets for mixers, pumps stirrers, etc.; the practical organiser for logbook, manuals, pens . . . you name it. Everything is on hand when you need it.

For the professionals there is a built-in quartz clock. You can keep your rotor refrigerated at standstill and pre-program a delayed start up to 99 hours later. Ideal for weekend separations: on Monday morning your samples are ready and you have saved a day!

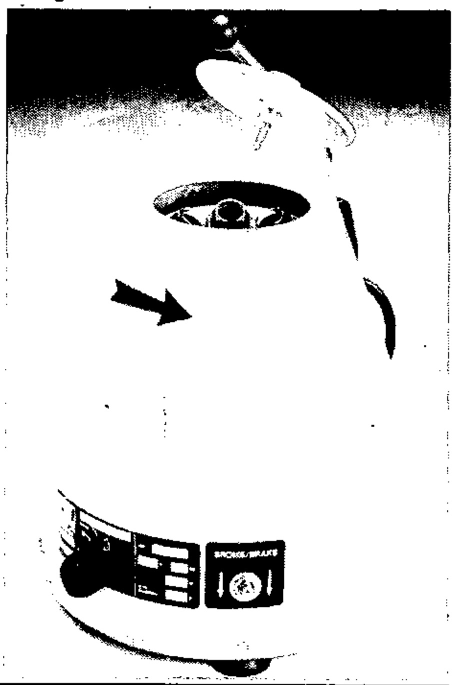
For further information contact Roche Products, or circle 7 on the reader reply card.

WIFUG

Wifug Lab. Centrifuges are a division of Eltex of Sweden Limited manufacturing laboratory centrifuges at their works in Bradford, England. They manufacture a range of units to suit most applications in biological and chemical separation.

Wifug centrifuges are produced to strict quality controls to ensure a long life and a large range of accessories are available for maximum utilisation. All units are made to internationally recognised safety standards.

Wifug Studie



A compact centrifuge fully encased with a transparent lid and safety lock. It is ideal for small laboratories, where space is at a premium, and for teaching work. The maximum 6 x 15ml capacity will produce up to 3000g at 6000 rpm.

Wifug Labor

Specifically designed for routine work in laboratories handling large numbers of tubes and available in 3 versions for 18 x 15ml, 6 x 50ml or 15 x 'Vacutainer' tubes. A maximum speed of 4500 rpm will produce 2250g.

Wifug Test and Chemico

Open rotor centrifuges designed to take 16 tubes of 2 or 3 ml capacity respectively at speeds up to 7000 rpm 4000g.

Wifug 500E

A microprocessor controlled bench centrifuge with a range of rotors and carriers which will achieve up to 5000 rpm (5000g) with a load of 6 x 100ml with speeds up to 7000 rpm producing 6,500g.

Wifug 2000E

A multipurpose centrifuge for laboratories requiring considerable flexibility combined with a high degree of accuracy. Fitted with microprocessor control and a wide range of accessories this unit can take up to 4 x 500ml with speeds up to 7000 rpm producing 6,500g.

Wifug 4000E

A high capacity (4 x 1000ml) bench centrifuge perfect for general purpose use and more stringent applications. A wide range of rotors and carriers including some specialised systems will achieve 6500g at 7000 rpm.

Wifug Haemicrofuge

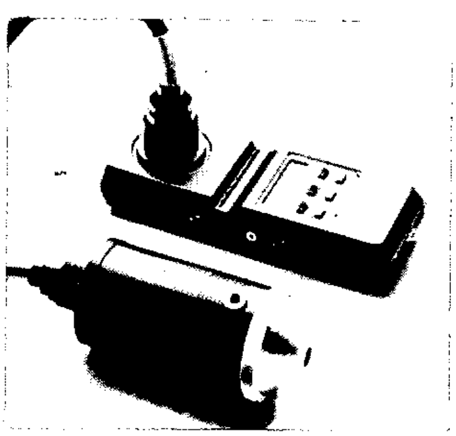
A microhaematrocrit centrifuge which can easily be converted to microcentrifuge using a series of tube support plates. The top speed of 10,500 rpm produced 12,000g.

Sole NZ agents for Wifug are John Morris Scientific, Auckland and Wellington. For further information circle 10 on the reader reply card.

PRODUCT NEWS

Chroma Meter II Reflectance

The compact Chroma Meter II Reflectance offers high-precision measurement of reflected colour, plus instant readings of colour deviation, making it an ideal meter for product quality control as well as a wide variety of scientific and industrial uses. For extremely reliable readings, the measuring head employs a powerful pulsed xenon arc (PXA) lamp monitored by a special double-beam feedback system. Measurements are processed by a built-in



micro-computer and displayed digitally on the liquid-crystal display in any of five measuring modes. The meter can be calibrated to the user's selected standard, and any number of meters can be unified by calibrating to the same standard. Terminals on the meter further extend its usefulness, permitting interfacing with computers and operation by remote control.

For further information contact the newly appointed sole N.Z. agents for Minolta Industrial Meters, Chemiplas Agencies Ltd, Auckland, or circle 8 on the reader reply card.

Clock-Timer has time Over Run display

This new electronic Clock-Timer has proved itself very useful in Laboratories, Darkrooms, and Research applications.

Its quartz accuracy makes it ideal for the most exacting purposes.

The Timer has a pleasant sounding alarm for 1 minute or until stopped, to remind you "time is up" for any occasion.

After stopping the last preset time returns. As the alarm rings the time displays exact time you have exceeded preset time.

Ideal for most laboratory and Research exact timing purposes. The Clock-Timer is available from Kempthorne Medical Supplies. For further information circle 9 on the reader reply card.

Analytichem International

Sci-Med is pleased to announce to their customers that they are now holding extensive stocks of Analytichem products. Of these, the best known is undoubtedly BOND-ELUT, the revolutionary bonded phase sample preparation medium. BOND-ELUT comes in the widest available variety of bonded phases, to allow the user to "custom-tune" selectivity for his or her particular analyte and matrix. A wide range of sample loading capacities is also provided for.

Analytichem and Sci-Med are interested in providing the answer to YOUR sample clean-up requirements and as such have a wealth of applications information on hand. For the toxicology and TLC lab there is TOX-ELUT and CHEM ELUT a diatomaceous earth support medium designed to greatly speed up liquid-liquid extractions. Sepralyte HPLC columns and bulk column packing materials are similarly available in a wide variety of bonded phases and particle diameters depending on your applications.

For further information, contact your nearest Sci-Med branch; or circle 11 on the reader reply card.

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What is your principal classification?

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The New Zealand Institute of Chemistry and The New Zealand Biochemical Society

Conference 1985

Christchurch New Zealand August 26-30 1985

Theme: Chemistry Becomes Computerized

Preliminary Notice

THE HOST CITY AND PROVINCE

Christchurch, with a population of 290,000, is the major population centre in the province of Canterbury and the largest city in the South Island of New Zealand. It was established at the base of the hills of Banks Peninsula on an alluvial plain which slopes gently from the sea in the east for some 65km to the foothills of the Southern Alps in the west.

Christchurch was named after the Oxford College of John Robert Godley, leader of the settlers who arrived in the "First Four Ships" in 1850.

The combination of the tree lined Avon river meandering through the city, the focal point of the Cathedral Square, the fine old buildings, and the many parks, gardens and recreation grounds give Christchurch a character of its own.

The well tended streets and gardens have earned Christchurch the title of "Garden City" and a reputation for being the most English city outside England.

Christchurch offers an abundance of attractions to visitors. For those wishing to dine out, an expanding number of restaurants cater for every taste. Cultural facilities include the Museum, Art Gallery and Arts Centre — an exciting use of the former University of Canterbury site which houses theatres, restaurants, a cinema, craft shops, and features Ernest Rutherford's den. The Town Hall, featured on this brochure, attracts a full programme of visiting national and international artists.

The city has a range of sporting facilities. Queen Elizabeth II Park, east of the city, was the venue of the 1974 Commonwealth Games and features heated indoor pools and a hydroslide. Hagley Park, in the city centre, caters for most organised sports and contains walking, jogging and cycling tracks.

Resorts within easy travelling distance of Christchurch include Akaroa, a picturesque resort of French origin on Banks Peninsula; Hanmer, a thermal resort north of Christchurch; and Methven, a winter resort close to the skiing facilities of Mount Hutt. Mount Hutt (104km from Christchurch) is one of the highest skifields in the Southern Hemisphere and has an unusually long season. The other commercial ski field close to Christchurch is Porter Heights (100km away).

Both fields are generally operating in August and within easy reach by day trip to Conference visitors. Fields such as Tekapo and Coronet Peak should also be considered by visitors able to travel further south before or after Conference.

WEATHER CONDITIONS

By late August the first signs of Spring should be appearing in Christchurch. However the weather is likely to remain cool (average maximum for August 12°C, average minimum +2°C) with some overnight frosts, although these are usually followed by sunny days. There may also be some wet days.

CONFERENCE VENUE — UNIVERSITY OF CANTERBURY

The University of Canterbury at Ilam is the venue for the Conference, and is conveniently located on bus routes between Christchurch International Airport and the city centre.

The growth of the University of Canterbury from a small liberal arts college to a modern autonomous university with a high reputation for the quality of its teaching and research has been matched by its physical expansion.

When it was established in 1873 it was only the fourth university institution in New Zealand and Australia. It was housed in graceful stone buildings elaborated with cloister and quadrangle, pinnacle and tower, near the city centre. These buildings are now the Arts Centre.

When the transfer of the University to Ilam was completed in 1974 it was much better housed, staffed and equipped than ever before. The spacious modern buildings, with a floor area of 130,000 square metres in a park like setting of 71 hectares have become the home for a community of nearly 10,000 students and staff. There are more than 420 academic staff in more than 50 different subject areas grouped into seven faculties: Arts, Science, Commerce, Engineering, Law, Music, Fine Arts and Forestry. Each year some 1500 graduates, about 200 of them with higher degrees, enter the workforce or undertake further training.

The conference sessions will take place in the science lecture theatres alongside the Chemistry Department in the heart of the campus.

CONFERENCE THEME: CHEMISTRY BECOMES COMPUTERIZED

The general theme of the conference will be "Chemistry Becomes Computerized," supported by plenary and invited lectures, technical displays and workshop sessions which will illustrate the variety of ways in which computers are being used by chemists in laboratory management, data processing, instrument control and other research areas. Computers in chemical education will also be given prominence.

The usual specialist group sessions will be available for the presentation of short papers and posters. The use of posters will be encouraged through the timetabling of sessions during which the presenters will give a very brief outline of the work described in their posters.

Another feature of the conference will be the Vaughan Symposium, honouring the retirement of Professor J. Vaughan.

SOCIAL PROGRAMME

The highlight of the social programme of Conference will be a Conference dinner held in the Christchurch Town Hall. The programme of social events for delegates and those accompanying them will also include the usual mixers and visits to local industries and other places of interest.

Those attending Conference will be able to use the University Recreation Centre (which offers tennis, squash, badminton, trampolining etc) and socialize at the University Staff Club based in the gracious Ilam Homestead. Both are sited on campus. If there is sufficient demand, skiing trips will be arranged to nearby Mount Hutt or Porter Heights on the Friday following the conference.

ACCOMMODATION

Accommodation is available in modern single rooms at the Halls of Residence on the campus and within walking distance of the conference venue. There are also a few double rooms. Tea and coffee making facilities are available. The Halls are on bus routes, both from the Airport and to the city centre. The estimated cost is about $24/day for full accommodation and meals. There is also a limited amount of motel accommodation available close to the venue. Early bookings will be essential for this. Please contact:

Dr J. R. L. Walker,
Botany Department,
University of Canterbury,
Christchurch,
New Zealand

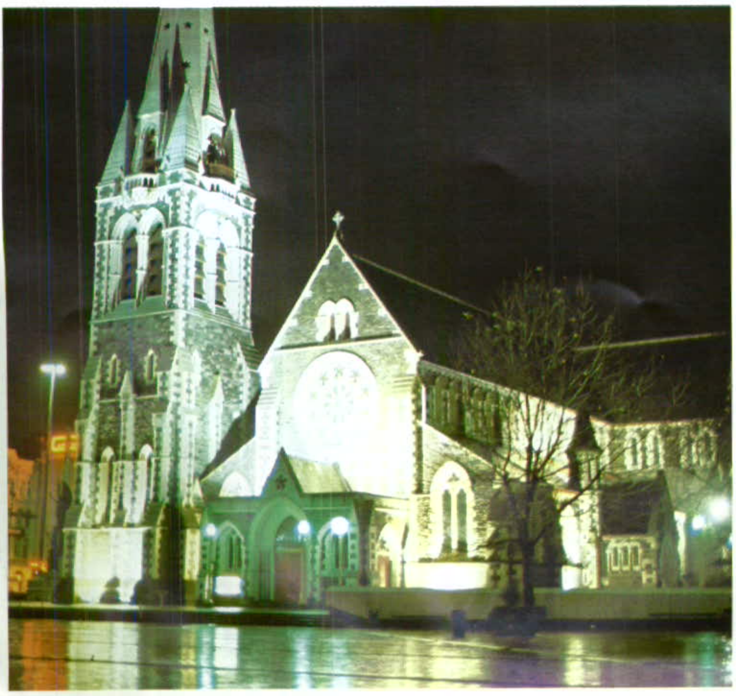
FURTHER INFORMATION

Office holders on the organizing committee for the 1985 Conference are:

Chairman	Dr W. H. Swallow
Secretary	Dr P. W. Harland
Treasurer	Dr C. G. Freeman

For further information regarding the conference itself contact:

Dr P. W. Harland,
Conference Secretary,
Chemistry Department,
University of Canterbury,
Christchurch,
New Zealand



The right brain/program package to formulate, count, weigh.

You know the dilemma only too well: on a lot of milligram balances you get stopped short, because you can weigh only **either** the tare **or** the sample. Not so with Sartorius 1400 milligram weight processors.

Range-conscious as ever, we provide up to 420 g with a rocksteady display for meticulous weighing with milligram perfection. You need on-the-dot weighing-in? You have come to the right address: the Sartorius display update is stepped up automatically during formulations, so you

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That's formulation optimizing!

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That's operational flexibility! That's systems design! That's perfect milligram sensitivity! That's programmable efficiency! That's the right design for analytical jobs! That's range selection!

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Private Bag, Auckland 9, Phone: 483-039
P.O. Box 1813, Christchurch, Phone: 63-661

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