Chairman's Report on Activities during 1995

The Environmental Chemistry Group's progress through 1995 saw further notable landmarks following our twenty first birthday noted in my report last year in the first issue of this Newsletter. The 100th meeting of our Committee took place on 28 September and was marked by a luncheon attended by past Chairmen Professors Roy Harrison, Ron Hester, Mr Geoff Dickes and Dr. Alan Robertson (the first Chairman). Best wishes were received from all other living past Chairmen who sadly were unable to attend. I look forward to a similar celebration of the 200th meeting in about 20 years time - I hope you will invite me.

The computer age finally caught up with us and we now have our own World Wide Web page where you will be able to read our Newsletter and much other useful information about the Group's activities: the address is http://chemistry.rsc.org/rsc/. The Group has also registered under the Data Protection Act to meet a legal requirement in respect of our computerised membership data.

Issue number one of the Environmental Chemistry Group Newsletter came out in January 1995 and issue two in August. I would like to offer my thanks to the editors Rupert Purchase and Delyth Forsdyke. I think the Newsletters are both interesting and informative. What do you think? If you would like to express a view please write to Dr. Rupert Purchase, 38 Sergison Close, Haywards Heath, West Sussex, RH16 1HU. All comments will be most welcome, and interesting communications will be published. Look out for issue number three early in 1996.

During 1995 the Group has organised or been associated with meetings on:

- Environmental Management Systems for the Chemicals Industry
- Effluent Toxicity and Treatability
- Waste Disposal
- Contaminated Land.

After having to report last year that attendances at meetings were down, I'm pleased to report a significant upturn this year. Thus encouraged, the Committee is developing a full programme of meetings for 1996 which we hope you will enjoy.

Enjoyable was certainly the word to describe our 1994/95 Distinguished Guest Lecture delivered by Professor A.K. (Joe) Barbour which asked the question 'Environmental Criteria - Science Based or Regulatory Responses to Public Concerns?' and answered it as only Joe can!

As the Millennium approaches, the Group held an essay competition for its younger members who were invited to submit 2000 words on the current and future roles for chemistry in an environmental topic of their choice. Prizes, generously donated by Bechtel Ltd., and ICI, will be presented at the AGM to the winners in each age group.

As I reported last year the Group wishes to retain strong links with Industrial Division through our membership and our programme of events. The Committee, which retains a balance of industrialists and academics, will take the initiative during 1996 to foster links with the Division following its reorganisation.

Geoff Dickes who has represented the Society on the Federation of European Chemical Societies Working Party on Chemistry and the Environment is

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ECG Newsletter No.3 February 1996

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standing down after twelve years including six as Chairman. I would like to thank and congratulate Geoff on behalf of the Group for his sterling work. I shall be replacing him and know that I have a hard act to follow.

My two years as Chairman of the Group are up and I shall be handing over the Chair to Professor Nick Hewitt after the AGM. I would like to extend my thanks to Nick who has been Vice-Chair, Peter O'Neill the Treasurer and Rob Gemmill the Secretary for their excellent support.

The thanks of the Committee also go to our retiring members, Marshall Askew, Mike Wright and Geoff Marshall.

J.V. Holder (Dr.)
December 1995

The 1995 Nobel Prize for Chemistry - Awarded for Achievements in Environmental Chemistry

Twenty years of study on the ozone layer have resulted in the first Nobel Prize ever awarded to atmospheric chemists. Recipients of the 1995 Nobel Prize for Chemistry were **Paul Crutzen** (Max Planck Institute for Chemistry, Mainz, Germany), **Mario Molina** (Massachusetts Institute of Technology), and **F. Sherwood Rowland** (University of California, Irvine).

In announcing the award, the Royal Swedish Academy of Sciences noted that "by explaining the chemical mechanisms that affect the thickness of the ozone layer, the three researchers have contributed to our salvation from a global environmental problem that could have catastrophic consequences."

Although the layer of ozone in the earth's stratosphere - the region 12 to 20 kilometers high (8 to 12 miles) - is relatively thin, it is crucial to life on earth because it absorbs the majority of the sun's ultraviolet radiation before it reaches the earth. Ozone (O_3) is formed when ordinary oxygen molecules (O_2) are split by ultraviolet radiation and then recombine with other oxygen molecules.

Crutzen showed in 1970 that the nitrogen oxides NO and NO_2 react with ozone to hasten its destruction without being destroyed themselves. These nitrogen oxides occur when microorganisms in soil produce nitrous oxide (N_2O).

Five years later, Molina and Rowland published a landmark article in *Nature* showing the threat to the ozone layer from chlorofluorocarbon (CFC) gases, which were being used widely in spray cans, refrigerators, and plastic foams. The two scientists realised that CFCs, which are chemically stable, could gradually be transported through normal air circulations to the stratosphere. There, intense ultraviolet light could break up the molecules, releasing chlorine, which catalyses ozone destruction (just as nitrogen oxides do).

Although controversial at first, the Molina-Rowland hypothesis was strengthened in 1985 when a drastic seasonal depletion of stratospheric ozone over Antarctica - the "ozone hole" - was discovered. Smaller but still significant depletion has been found above the midlatitudes and over the Arctic.

Why is the depletion so rapid and severe over the Antarctic? Crutzen and colleagues found that the chemical reactions were taking place on the surfaces of polar stratospheric clouds. These rare clouds are formed by water and nitric acid at extremely cold temperatures, primarily over Antarctica.

Through United Nations involvement, the Montreal Protocol on prohibition of CFC emissions was signed in 1987 and strengthened thereafter. With a few exceptions, the most dangerous gases will be completely banned by 1996. Still, the long lifetime of these gases means that damage to the ozone layer is likely to worsen for some years to come. Even if protocol guidelines are followed, it will take at least 100 years for the ozone layer to recover.

[The lectures which accompany the presentations of Nobel prizes for chemistry are published in *Angewandte Chemie (International Edition)*]

The Approach of Her Majesty's Inspectorate of Pollution to Regulatory Monitoring

Introduction to HMIP and its Regulatory Responsibilities

Her Majesty's Inspectorate of Pollution (HMIP) was formed in 1987 when the functions of the Industrial Air Pollution, Hazardous Waste, and Radiochemical Inspectorates were consolidated with a newly formed Water Pollution Inspectorate. On the 1st April 1996 HMIP will combine under authority conferred by the Environment Act 1995 with the National Rivers Authority (NRA) and the Waste Regulation Authorities (WRAs) to form an Environment Agency.

HMIP protects the environment by enforcing regulations to prevent pollution. It is the statutory authority in England and Wales responsible for:

- Authorisation and regulation of the largest and most complex industrial processes prescribed for Integrated Pollution Control (IPC) under the Environmental Protection Act 1990 (EPA 90).

- Continued regulation of certain existing plants for their emissions to air under the Health and Safety at Work etc Act 1974 (HSWA 74). These processes are being progressively converted to regulation under EPA 90.

- Authorisation and regulation of premises which use, store and dispose of radioactive material, under the Radioactive Substances Act 1993 (RSA 93).

- Issuing consents for discharge of potentially polluting substances to sewers under the Water Industry Act 1991 (WIA 91).

The Inspectorate also has specific responsibilities for implementing research into pollution control and radioactive waste disposal, and providing expert advice to Government, Industry and Local Authorities.

IPC provides HMIP with a combination of powers over processes and their operation as well as over releases to the environment. This means that HMIP is not wholly dependent on information derived from measurement of releases. Prevention rather than cure (emphasis on cleaner or low waste technologies rather than on end-of-pipe technology; on eliminating or minimising the production of waste at source rather than on treatment of the wastes produced) is at the heart of HMIP's approach to its regulatory responsibilities. Nevertheless, monitoring remains a key element not only of regulatory control, but also of providing information to the public in the new climate of open regulation.

HMIP Monitoring Branch

HMIP's Monitoring Branch was formed in 1992. It exists to develop monitoring policy and procedures, commission and manage monitoring programmes and provide related assessment and guidance to Inspectors. The work of the Branch is currently divided between two teams. One takes responsibility for implementing and managing the Inspectorate's independent monitoring programmes. The other for formulating the Inspectorate's policy on monitoring, responding to Field Inspector requests for specific guidance and managing a suite of related study contracts designed to underpin and develop HMIP's monitoring programme.

Monitoring Branch (MB) works out of two main offices, Cameron House in Lancaster, and the Government Buildings at Westbury-on-Trym, in Bristol. The Branch also has Regional Monitoring Liaison Officers (RMLOs) placed in each of the seven main Operations Division regional offices, to assist in communications with Site Inspectors on a day to day basis. A Monitoring Liaison Committee sits every quarter to discuss general matters of mutual MB/Operations Division interest.

Monitoring Policy

HMIP looks to monitoring to fulfil a number of roles. First, to monitor compliance with limits and conditions specified in process authorisations. Secondly, to indicate/control efficient process operation. Thirdly, to provide information on pollutant releases into the environment with view to satisfying public concern about air and water quality, and to provide data for national and international inventories.

There are arguments that all regulatory-related monitoring should be carried out independently, by the Inspectorate or its representatives. However, HMIP recognises the growing complexity and sophistication of processes and monitoring techniques, and that process operators are best placed to implement effective site specific requirements. Therefore, HMIP favours operators carrying out monitoring of their own process releases, in conjunction with Inspectorate audits and a proportionate amount of independent check monitoring to confirm results and provide public reassurance that the system is working effectively and honestly.

Requirements on Process Operators

Under present arrangements, operators are required to use best available techniques for monitoring which HMIP regards as on-line continuous measurement systems linked to computer data storage wherever practical and not entailing excessive cost. In many instances these are not yet available and discontinuous measurements are more appropriate. Although operators are required to take the lead in advocating the monitoring that needs to be carried out, proposals have to satisfy the Site Inspector.

Auditing of operator monitoring involves Inspectors checking on appropriate sampling positions, maintenance and calibration of instruments, sampling and analytical procedures, and data recording.

Operators have to report the results of their monitoring to HMIP and these are placed on the Public Register except in agreed cases of confidentiality.

Independent Monitoring

HMIP's independent monitoring is contracted out to external environmental consultancies and laboratories. The independent monitoring commissioned by HMIP usually falls into one of three main categories:

- Routine Monitoring: Structured programmes of monitoring undertaken in accordance with a pre-determined schedule. These are being developed on a process specific basis (e.g. large combustion plant, minerals processes).

- Ad-hoc/Reactive Monitoring: To provide flexibility for Site Inspectors to commission rapid response additional monitoring as part of their inspection duties, or to follow up unusual results from the routine programmes.

- Site Surveys and Investigations: More detailed one-off site-specific investigations, normally including environmental monitoring and assessment of environmental impact using mathematical modelling and comparison with published environmental quality standards.

The quality of regulatory monitoring data is of paramount importance to HMIP. The Inspectorate promotes the quality of its independent monitoring data by:

- Requiring use of standard reporting forms, designed to note all essential measurement details, and so allow complete independent assessment to be made.

- Preferring the use of standard methods (e.g. BSI, EN, ISO).

- Encouraging the use of traceable reference/calibration materials.

- Auditing contractors on-site and in their laboratory work against submitted method protocols.

- Bringing complaints about performance, quality of results and reporting time-scales swiftly to the attention of contractors.

- Requiring contractors to be accredited according to UKAS (formerly NAMAS) as evidence of satisfactory quality assurance procedures.

- Encouraging participation in proficiency testing schemes.

- Encouraging certification of sampling personnel.

Supporting Studies

Monitoring Branch underpins its monitoring policy with a programme of related supporting studies. These are intended to fill in gaps in sampling, analytical techniques, assessment methodologies and basic requirements identified by HMIP. The main areas of interest at present include:

- Support to BSI, CEN and ISO regarding the drafting of new and revised monitoring standards.

- Identification of best available monitoring techniques for monitoring determinands or situations where standard methods are not available or foreseeable (e.g. fluoride, nitrous oxide, diisocyanates, metal fume, hydrogen sulphide, particulates in hot and wet emissions, and flare emissions).

- Review of the suitability and availability of continuous monitoring techniques for different industrial sectors (large combustion plant, incineration, chemical and metals), and consideration of performance criteria which could be adopted to underpin a monitoring instrument certification/type approval service.

- Review of ambient atmosphere monitoring techniques.

- Assessment of continuous monitoring systems for dioxin emissions.

- Expansion of a present database on water monitoring instruments to include details of stack emission and air quality monitoring equipment.

The Inspectorate publishes the findings of its supporting studies as HMIP Research Reports or in the Monitoring series of HMIP Technical Guidance Notes (TGNs) available through HMSO.

Concluding Remarks

HMIP's approach to regulatory monitoring provides a rigorous basis for the provision of monitoring data underpinned by technical studies and attention to quality and reliability.

R.J. Gemmill (Dr)
HMIP Monitoring Branch,
Westbury-on-Trym, Bristol
December 1995

Environmental Chemistry at Plymouth University

In 1972 an Environmental Chemistry Group was formed as part of the new School of Environmental Sciences at Plymouth. At that stage there were only three members of academic staff in the Group. Now there are nineteen academic staff and over fifty postgraduate and postdoctoral researchers forming part of the Department of Environmental Sciences in the Faculty of Science.

Researching Environmental Chemistry at Plymouth

Four major research areas have been established:

Environmental Analytical Chemistry which makes use of exceptionally well-equipped analytical instrumentation laboratories. There is particular emphasis on atomic spectroscopic, flow injection and liquid chromatographic techniques for determining the chemical species present in environmental samples. As well as developing so called "hyphenated methods" (where a number of techniques are bound together *e.g.* HPLC-ICP-MS) for laboratory use, we are also producing *in situ* monitoring systems that can be used in terrestrial, freshwater and marine environments. Such systems may be left unattended to gather data over periods of weeks.

Petroleum and Environmental Geochemistry where GC and GC/MS, including high temperature GC and pyrolysis GC/MS are used for the characterization of organics in a variety of sample matrices *e.g.* water, sediment, biota. These allow the fate of natural and anthropogenic organic molecules to be determined, and have been applied to study oil exploration techniques and the fates and origins of oil spills. This is one aspect of research in Environmental Organic Chemistry which also includes the development of alternative strategies in pest control based on the chemistry of insect-plant relationships.

Marine Chemistry is mainly studied in relation to shelf seas such as the North and Irish Seas. Quantitative evaluation of pollution metal transport in the coastal boundary zone is carried out in collaboration with Plymouth Marine Laboratory. The interactions between particulates and dissolved species is of special interest, as are the atmospheric inputs into enclosed seas such as the Mediterranean.

A **Diesel Exhaust Emissions** group collaborates with the Mechanical Engineering Department on the operation of a test diesel engine, and with Biological Sciences on mutagenicity testing of exhaust products. Over the years a detailed knowledge of the exhaust products of diesel engines has been built up.

Other research areas include powerful 3-dimensional computer modelling of the behaviour of fluids in porous media *e.g.* oil reservoir rocks, soils and paper coatings, and the study of chemical processes associated with landfill and other biological waste disposal methods.

A notable feature of the research is the collaboration that occurs between the environmental chemists from different research areas, with staff in other departments in the University and with industry and research institutes. This multidisciplinary approach is helped by the fact that the researchers are part of the Plymouth Environmental Research Centre which actively encourages joint activities between different groups. In the last Research Assessment exercise, which was the first we entered, a grading of 4 was obtained.

Teaching Environmental Chemistry at Plymouth

The research expertise and the associated instrumentation have a significant impact on the teaching of environmental chemistry.

Environmental Chemistry courses were first set up as part of the BSc (Hons) Environmental Science degree in 1973. Over the years there have been changes in context and detailed organisation, but the original concept of emphasising the study of the chemistry of natural environmental systems, and treating anthropogenic inputs as perturbations to these natural systems, has remained.

On the BSc Environmental Science course, students who choose the Environmental Chemistry option spend half of their second and third years studying chemistry. In their second year they also study Environmental Law, Statistical Computing and Resource Studies. In the third year as well as the compulsory project and an Environmental Management and Policy module, courses in Environmental Monitoring, Waste Management, Mathematical Modelling, Environmental Assessment, *etc.* are available. In addition to the theoretical and applied aspects of environmental chemistry, the students gain practical experience of sampling, *in situ* measurements, and a wide variety of analytical chemistry techniques and

instrumentation. Contact with industry and regulatory agencies *via* invited lectures and site visits are an important part of the course.

In 1992 we introduced a named Environmental Chemistry degree which is a specialist chemistry degree accredited by the Royal Society of Chemistry. For this course students spend at least 50% of their first year and all of their second and third years studying various aspects of chemistry. In their final year there is an emphasis on the chemistry of natural and polluted atmospheric, terrestrial and marine environments. In the practical programme there is, as with the Environmental Science based course, an emphasis on "hands on" experience of environmental sampling and analysis.

This approach is illustrated by the Environmental Techniques module in the first semester of year 2. On the first day the students visit a small catchment to collect stream water and sediment samples and also to make *in situ* measurements. In subsequent weeks the samples are used to give experience in various methods of treatment and analysis. Different techniques are directly compared by analysing the same samples, for example by ISE and UV spectrophotometry for nitrate; and colorimetry, AAS and ICP for iron. At the end of the semester all the results obtained by each student for all samples are collated. The students can then produce a report discussing (a) possible reasons for different values for a particular analyte and the significance of the difference; (b) the pros and cons of different methods; and (c) comparison of the geochemistry of the catchment with literature values for similar systems, leading to an environmental assessment of the site. The BSc (Hons) Environmental Chemistry course is designed to produce professional chemists with an understanding of the chemistry of environmental systems in addition to their general chemical knowledge. The BSc (Hons) Environmental Science graduates have a broader knowledge of the environment and the interactions between cultural, physical and biological systems. In the 1994/95 HEFCE Teaching Quality Assessments the Environmental Sciences courses at Plymouth gained the highest possible grading of "excellent".

Further information about the Environmental Chemistry and Environmental Science degree courses can be obtained from Dr Roy Lowry, Department of Environmental Sciences, Plymouth University, Plymouth, PL4 8AA.
Tel: 01752-233000; Fax: 01752-233035; E-mail: rlowry@plymouth.ac.uk.

The Role of the RSC's Environment, Health and Safety Committee

The Environment, Health and Safety Committee [EHSC] was set up in the late 1970s as a committee of the then Professional Affairs Board of the Royal Society of Chemistry. Following a reorganisation last year of the Society's Committee and Board structure, the EHSC now reports to the Scientific Affairs Board and forms the Society's "focus" for professional and policy aspects of environment, health and safety. The terms of reference of the EHSC are very wide but essentially they are aimed at meeting three broad objectives.

First, the committee aims to provide a service to members. The committee's Secretary deals with members' enquiries by post and telephone, after taking advice from the committee as necessary. Enquiries range from simple requests for factual information to more complex matters such as, for example, a member who was dismissed because of a dispute over health and safety issues. Enquiries are also received from non-members and other organizations.

The committee publishes documents of various types to assist members in their work. Three **Guidance Booklets** have been produced to give the sort of detailed "how to do it" advice required by practitioners:
Safe Practices in Chemical Laboratories [1989]
COSHH in Laboratories [1989]

Guidance on Laboratory Fume Cupboards [1990].

These booklets are sold at a reduced price for Members and can be obtained in the same way as other RSC publications. They focus on the particular problems faced in laboratories because the committee has taken the view that the Society can make a unique and valuable contribution in this area. The booklets are revised as the need arises and as resources permit. For example the booklet on COSHH in Laboratories has recently been extensively updated to take account of comments received on the first draft, changes in the legislation, and experience in implementing COSHH. The new edition will be on sale shortly.

In addition to the Guidance Booklets, the committee produces short papers [such as **Professional Briefs** and **EHSC Notes**] which are advertised in *Chemistry in Britain*, and are free to members on request. These documents have a variety of aims - from giving

general background information and the consensus views of experts on a particular issue [*e.g.* food irradiation], to setting out the committee's views on a contentious subject as the basis for comment and discussion [*e.g.* the potency of chemical carcinogens] . Nonetheless all EHSC booklets and other documents differ from those published by the Society's Information Services in that EHSC documents give the consensus views of experts on behalf of the Society rather than the views of an individual author. EHSC publications therefore represent a "Society view" on the issue considered.

The second of the EHSC's broad objectives is to make representations in the public interest to try to ensure that policy and legislation are based on sound chemical science. This is achieved by a variety of means such as meetings and making submissions on consultation and other documents. The committee has also undertaken contract studies for the European Commission for over ten years. The reports arising from these studies have covered topics such as :

- health risks from common solvents
- methods for determining carcinogens in workplace air
- long-term neurotoxic effects of paint solvents
- simple air monitoring techniques for small companies
- guidance on management and control of wastes
- control of chemical hazards in small companies
- protection of workers handling wastes.

Most of these reports have been published as RSC books. They give factual information but also evaluate data and views and offer guidance where appropriate. Finally the reports may be taken into consideration by the Commission at an early stage in the development and formulation of European policies and legislation.

The third of the committee's broad objectives is to try to ensure that the public's views on environment, health and safety issues relating to chemicals and chemistry are based on a proper understanding of the chemistry involved. The committee pursues this objective by organizing meetings and by issuing documents which are aimed either directly at the public or at members who can then better disseminate information and expert views to the public. Recent examples include a public meeting on re-cycling wastes as part of the 1995 Edinburgh Science Festival and the preparation of a series of Professional Briefs on different types of food additives.

In order to fulfill the remit of the EHSC, committee members are drawn from a wide range of academic, industrial and regulatory backgrounds and include specialists in occupational health, toxicology, environmental chemistry, medicine, and insurance.

Much of the committee's detailed work is carried out by Working Parties which have a deliberate limited working-life. The composition of these is normally a mix of appropriate EHSC members and invited experts who are not members of EHSC - and, where there is need for a particular expertise, may not even be RSC members.

The EHSC would be delighted to hear from anyone who wishes to be considered for membership of the committee as and when vacancies arise, and/or would like to be considered for inclusion in a future Working Party. If you think that you have an appropriate expertise, please send a summary of your CV to Bob Hazell, Health, Safety and Environment Officer at The Royal Society of Chemistry, Burlington House, Piccadilly, London W1V 0BN.

In carrying out its work the EHSC is grateful for expert input from the other parts of the Royal Society of Chemistry which are formally represented on the committee. The Environmental Chemistry Group [ECG] was the first Subject Group with which the EHSC established cross representation. The ECG remains one of the committee's closest and most valuable links although the two groups have distinctly different roles. The Environmental Chemistry Group exists primarily to organise scientific meetings while the role of the EHSC is to formulate policy and professional guidance. Both the ECG and the EHSC now report to the Society's Scientific Affairs Board and this arrangement is expected to further facilitate liaison in the future.

In deciding which projects to undertake, the EHSC takes account of the views of other RSC groups on the committee and of the RSC membership. Communication between the EHSC (and the RSC in general) and its members will be enhanced with the introduction in 1996 of new mechanisms for obtaining a better feedback from members in all areas of the Society.

Suggestions from ECG members on the activities of the EHSC and its publications are welcomed, and should be sent to Bob Hazell at Burlington House.

R. W. Hazell
Health, Safety and Environment Officer
Royal Society of Chemistry
Burlington House, London
December, 1995

A New Review Series on Environmental Science from the Royal Society of Chemistry - *Issues in Environmental Science and Technology*

Have you ever wanted to know about the environmental impact of gold mining in the Brazilian Amazon? Or were curious about how to utilise energy from waste incineration? Or wondered about the alternatives to CFCs and their effect on the atmosphere?

Public awareness and concern about the environment has increased dramatically in recent years. But often the facts in specific cases are not presented clearly, and those without specialist knowledge are left questioning where the truth really lies.

In 1994 **The Royal Society of Chemistry** (RSC) launched a new review series, ***Issues in Environmental Science and Technology***, to answer the need for concise, authoritative and up-to-date commentaries on current topics of environmental concern. Two volumes in this series are published each year, and each volume describes the underlying chemistry of environmental processes and any wider economic, legal, and political considerations. Contributions to the series are from recognised experts in the environmental sciences.

In the first volume, **Mining and Its Environmental Impact** (1994), a general overview is followed by more detailed analysis, in eight chapters, of particular aspects of mining - the environmental impact of goldmining in the Brazilian Amazon; methods of green coal mining; the reconstruction of ecosystems after mining; and pollution which results from the discharges of methane and contaminated water from active or abandoned mines. **Mining and Its Environmental Impact** offers solutions to the economic, technological and environmental problems associated with mining, and is key reading for practitioners, researchers and environmentalists in general.

Environmental problems caused by incineration are examined in the second volume in the series, **Waste Incineration and the Environment** (1994). The effect of emissions of trace metals and organic micropollutants from incinerators on the environment are reviewed, and methods for the environmental assessment of incineration are described together with currently available control technologies.

Incineration of municipal waste coupled with energy recovery is an efficient means of bulk waste reduction and is favoured as an alternative to landfill operations. For the disposal of many chemical wastes, incineration is the only viable option. The seven reviews in **Waste Incineration and the Environment** provide an impartial account of the scientific and technical issues involved in using incineration as a method of waste disposal.

Further aspects of waste disposal are dealt with in the third volume of this RSC series, **Waste Treatment and Disposal** (1995). Waste management can result in discharges into the atmosphere or into inland and coastal waters. **Waste Treatment and Disposal** reviews the localized impacts of such discharges, and the regulatory framework within which management operates. The design, operation and control of landfill sites, technical issues facing the recycling industry, and the safe underground storage of radioactive waste are also described . As with the preceding volumes of ***Issues in Environmental Science and Technology***, the benefits and environmental impacts of the various issues raised are examined in a factual and balanced way in its seven chapters.

The latest addition to the series, **Volatile Organic Compounds in the Atmosphere**, (1995) outlines the atmospheric chemistry of volatile organic compounds (VOCs) and includes, in eight chapters, reviews of the role of VOCs in the formation of lower atmosphere photochemical ozone; alternatives to CFCs and their behaviour in the atmosphere; the sources, concentrations and human exposure to indoor VOCs; and accounts of the UK Hydrocarbon Monitoring Network and the development of UK policy for atmospheric VOCs.

The editors of ***Issues in Environmental Science and Technology*** are both former chairmen of the RSC's Environmental Chemistry Group: Ronald Hester, Professor of Chemistry at the University of York, and Roy Harrison, Professor of Environmental Health at the University of Birmingham. The international advisory board for the series includes Paul Crutzen, who, as noted elsewhere in this Newsletter, was awarded the 1995 Nobel Prize for Chemistry, and other scientists who are widely recognised for their contributions to the understanding of

processes which influence the environment.

The titles of the two volumes due to be published in 1996 are **Agricultural Chemicals and the Environment** and **Chlorinated Organic Micropollutants.** Subjects for future issues include power generation from fossil fuels and alternatives; clean technology; the scope and limitations of recycling; and the chemistry of the oceans. All the volumes in the series are fully indexed.

Issues in Environmental Science and Technology can be purchased either through an annual subscription for the two volumes per year, or individual titles from the series can be bought singly. Details may be obtained by contacting the Sales and Promotions Department at the Royal Society of Chemistry on 01223 420066.

Issues in Environmental Science and Technology
Edited by R. E. Hester
University of York
R. M. Harrison
University of Birmingham

This series has been created to meet the acute need for concise, authoritative and up to date reviews of current environmental issues. Two volumes will be published each year, with each one addressing a specific theme or topic.

Ref No 1038
1. Mining and its Environmental Impact
Softcover xvi + 164 pages
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2. Waste Incineration and the Environment
Softcover x + 158 pages
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3. Waste Treatment and Disposal
Following on from Issue 2, this provides a thorough and detailed review of other waste management options, their environmental impact, the effects of changes in regulatory policy, and the technical issues involved.
Softcover x + 158 pages
ISBN 0 85404 210 5 1995 Price £15.00

4. Volatile Organic Compounds in the Atmosphere
This book covers stratospheric ozone depletion by CFCs, alternative substances, the role of VOCs in lower atmosphere photochemical ozone, and the problem of direct toxicity of VOCs such as benzene.
Softcover c. 160 pages
ISBN 0 85404 215 6 1995 Price £15.00

SYMPOSIUM

Air Pollution in the United Kingdom

(Sponsored by the RSC Environmental Chemistry Group
and RSC North-West Analytical Division)

This one-day symposium will be held on Monday 23rd September 1996 at the University of Lancaster

The programme for this meeting includes the following speakers:

Dr Martin Williams (DoE)	*UK and EU legislation on air pollution*
Dr Dick Derwent (Meteorological Office)	*Global air pollution problems*
Professor Roy Harrison (Birmingham University)	*Urban air pollution in the UK*
Dr John Ayres (provisional)	*Health effects of air pollution in the UK*
Professor David Fowler (Institute of Terrestrial Ecology)	*Rural air pollution in the UK*
Dr D. Crump (Building Research Establishment)	*Indoor air pollution*
Dr Steve Read (EnviroTechnology plc)	*New measuring techniques in air pollution*

For further details of this meeting, please contact the course organisers:

Professor C.N. Hewitt, Institute of Environmental & Biological Sciences, University of Lancaster. Tel.(direct) 01524-593931, Fax 01524-593985;

Dr Gerry Davison, Marketing & Commercial Liaison, University House, University of Lancaster. Tel. 01524-65201 ext. 4524/4084, Fax 01524-594069

Environmental Management Systems for the Chemicals Industry

Environmental Management Systems (EMS), their benefits and implementation, were discussed at a one-day meeting sponsored jointly by the RSC's Environmental Chemistry Group and the law firm Nabarro Nathanson and held in London on September 29th 1995.

Perspectives on the currently available EMS were provided by the seven speakers at the meeting - Alan Duncan (Her Majesty's Inspectorate of Pollution), Jon Faragher (Chemical Industries Association, UK), Paul Leinster (SmithKline Beecham, Worthing), Michael Renger and Gareth Watkins (both from Nabarro Nathanson), Keith Taylor (Rhône-Poulenc Rorer), and Andrew Bale (Dames and Moore, London).

An EMS offers many benefits to an organisation: cost reduction, competitive advantage, risk management, reduced liabilities, compliance, and credibility. But in purely legal terms it is considered to be the development of responsibility and authority, particular once in court where the EMS may of value as evidence of intent.

A form of EMS is implicit in Integrated Pollution Control (IPC) The process of IPC application/authorization involves many of the concepts of EMS, including objectives and targets, reviews and assessments. The major difference between the legislative approach of IPC and the managerial emphasis of EMS appears to be one of aspiration. Regulation alone cannot achieve this, but is necessary to act as a backup for those whose aspirations may be inadequate.

The possible over-bureaucratic nature of management systems may be of concern. A combination of health, safety and environmental procedures seems a logical step, and is the aim of the Chemical Industries Association's Responsible Care programme. Legal precedents suggest that the lack of a well structured health and safety system will almost certainly ensure corporate liability.

The tangible benefits of introducing an EMS were illustrated with some statistics from Rhône-Poulenc Rorer's site at Avonmouth. Accident rates have fallen from 26 to 1.9 per 100,000 hours and the aqueous environmental index is only 8% of the 1990 average. The improvements came as a result of writing effective operating procedures, improving skills, and cultivating an attitude of "we want to do it right". This final sentiment exemplifies the difference expressed by Alan Duncan - the difference between want and need.

Further details of this meeting may be obtained from Michael Renger or Anthony Hobley of Nabarro Nathanson on 01302 344455.

SYMPOSIUM

Young Environmental Chemists Meeting

(Sponsored jointly by the RSC Environmental Chemistry Group and De Montfort University)

This one-day meeting, which will be held on Tuesday 5th March 1996 at the Department of Chemistry, De Montfort University, is intended to be a vehicle for the presentation of new work in environmental chemistry by younger workers and will also include the **RSC John Jeyes Lecture**.

The programme will consist of up to ten talks by younger Environmental Chemists (MPhil/PhD students and postdoctoral workers). In conjunction with this programme the RSC John Jeyes Lecture on the **Chemistry of the Urban Atmosphere** will be given by Professor Roy Harrison of Birmingham University. There will also be one other senior invited speaker. In addition to the talks there will an opportunity to take part in a poster session - posters will be displayed throughout the day with a plenary poster session in the afternoon, and it is hoped to present prizes for the best posters and presentations.

Young chemists who are working on a chemistry project with an environmental theme are invited to attend this meeting. The event is designed to allow fruitful exchanges of information in the area of environmental chemistry, and to provide experience in the presentation of work to an audience plus an opportunity to meet fellow workers. Although the theme of the meeting is for younger workers, a number of experienced chemists at the research supervisory level will also be attending.

Registration for this meeting will be about £25.00, and a limited number of bursaries to assist with attendance will be available.

For further details please contact **Professor P.J. Craig, Department of Chemistry, De Montfort University, The Gateway, Leicester LE1 9BH** Tel: 0116 2577102 Fax: 0116 2577135

Forthcoming Symposia

The following symposia and lectures on environmental topics, sponsored by the RSC and similar organisations and arranged for the first part of 1996, have come to our attention:

Stack Emissions: Monitoring, Modelling and Impact Assessment, sponsored by the SCI Environment & Water Group, 14/15 Belgrave Square, London 7 February 1996

Volatile Organic Compounds, sponsored by the Royal Society of Chemistry and IBC Technical Services Ltd, Forte Crest Hotel, Birmingham, 14 February 1996 (telephone 0171 637 4383 for details)

Environmental Issues Facing Edible Oils Industry, sponsored by the SCI Oils and Fats Group, 14/15 Belgrave Square, London, 14 February 1996

Desk-Top Studies In Investigations Related to Contaminated Land, sponsored by the SCI Construction materials Group and the Environment & Water Group, 14/15 Belgrave Square, London, 22 February 1996

Young Environmental Chemists Meeting, sponsored by the RSC Environmental Chemistry Group, Department of Chemistry, De Montfort University, Leicester, 5 March 1996. This meeting will also include the RSC John Jeyes Lecture to be given by Professor Roy Harrison (see also next entry)

The Chemistry of the Urban Atmosphere, RSC John Jeyes Lecture and RSC Environmental Chemistry Group Distinguished Guest Lecture (Professor Roy Harrison, University of Birmingham) plus supporting programme, Scientific Societies' Lecture Theatre, London, 2.0 p.m., 7 March 1996. (The ECG will hold its Annual General Meeting during this symposium).

Closure of Industrial Sites, sponsored by the SCI Environment & Water Group, 14/15 Belgrave Square, London, 14 March 1996

Waste Incineration, Mr Ray James, Rechem International, sponsored by the SCI Bristol Section, School of Chemistry, Bristol, 21 March 1996

Phosphate in Water in Losses from Agricultural Land, sponsored by the SCI Agricultural & Environment Group, 14/15 Belgrave Square, London, 26 March 1996

Toxic Impacts of Waste on the Aquatic Environment, sponsored by the RSC Water Chemistry Forum, Loughborough University, 14-17 April 1996 (for details contact Elaine Wellingham 01275 853311)

Acid Mine Drainage Water - The Problem and Potential Solutions, sponsored by the SCI Environmental Biotechnology Group + Separation Science & Technology Group, 14/15 Belgrave Square, London, 24 April 1996

Analytical Measurements and their Interpretation for Regulatory Purposes, sponsored by the RSC Analytical Division, Hilton National Hotel, Bath, 14-15 May 1996 (contact Ms Paula Elliott, RSC, Burlington House; tel: 0171 437 8656 for details)

Details of the RSC Environmental Chemistry Group Meetings will be sent in advance to all ECG members; enquiries about SCI-sponsored meetings should be addressed to the Conference Secretariat, SCI, 14/15 Belgrave Square, London SW1X 8PS Tel: 0171 235 3681, Fax: 0171 823 1698.

Recent Books on the Environment at the RSC Library

The following books and monographs on environmental topics have been acquired by the RSC library, Burlington House, during the period July - December 1995.

Agenda 21: Earth's Action Plan, Robinson, N.A. (ed.), New York, Oceana Publications, 1995. 683 pp. Accession No: 950467 Reference Shelves REF 628.5 R

Barbour Index Water Quality Microfile (Index valid until Mar 1996), Windsor, Barbour Index, 1995. 124 pp. Accession No: 950657 Reference Shelves REF 014.3:628.1 R

Bathing Water Quality in England and Wales 1994: Report of the National Rivers Authority (NRA), London, HMSO, 1995. 80pp. Accession No: 950359 West Gallery 626.881:615.838.3

CEFIC Guidelines for the Communication of Environmental Information to the Public, Brussels, CEFIC, 1989. 12 pp. Accession No: 950589 Reading room 061.5:66

CEFIC Guidelines on Transfer of Technology (Safety, Health and Environment Aspects), Brussels, CEFIC, 1991. 25 pp. Accession No: 950588 Reading room 061.5:66

Chemistry of Waste Minimization, Clark, J.H. (ed.), London, Blackie Academic, 1995. 554 pp. Accession No: 950441 West Gallery 622.17:66

The CHEMSAFE Manual: Chemical Industry Scheme for Assistance in Freight Emergencies, 3rd edition, London, Chemical Industries Association, 1991. 29 pp. Accession No: 950599 Reading room 061.5: 66

Chief Inspector's Guidance to Inspectors: Toluene Di-isocyanate Use and Flame Bonding of Polyurethanes, London, HMSO, 1995. 30 pp. Accession No: 950342 West Gallery 628.5:502.3

Chief Inspector's Guidance to Inspectors: Di-isocyanate Manufacture, London, HMSO, 1995. 35 pp. Accession No: 950343 West Gallery 628.5:502.3

Chief Inspector's Guidance to Inspectors: Textile Treatment Processes, London, HMSO, 1995. 32 pp. Accession No: 950344 West Gallery 628.5:502.3

Chief Inspector's Guidance to Inspectors: Timber Preservation Processes, London, HMSO, 1995. 26 pp. Accession No: 950345 West Gallery 628.5:502.3

Chief Inspector's Guidance to Inspectors: Tar and Bitumen Processes, London, HMSO, 1995. 31 pp. Accession No: 950346 West Gallery 628.5:502.3

Chief Inspector's Guidance to Inspectors: Papermaking and Related Processes, Including Mechanical Pulping, Recycled Fibre and De-inking, London, HMSO, 1995. 54 pp. Accession No: 950347 West Gallery 628.5:502.3

Chief Inspector's Guidance to Inspectors: the Making of Paper Pulp by Chemical Methods, London, HMSO, 1995. 44 pp. Accession No: 950348 West Gallery 628.5:502.3

Chief Inspector's Guidance to Inspectors: the Application or Removal of Tributyltin or Triphenyltin Coatings at Shipyards or Boatyards, London, HMSO, 1995. 23 pp. Accession No: 950349 West Gallery 628.5:502.3

Chief Inspector's Guidance to Inspectors: Processing of Animal Hides and Skins, London, HMSO, 1995. 31 pp. Accession No: 950350 West Gallery 628.5:502.3

Code of Practice for the Safe Handling of Anhydrous Ammonia in Bulk by Rail in the UK, London, Chemical Industries Association, 1975. 34 pp. Accession No: 950612 Reading room 061.5: 66

Codes of Practice for Chemicals with Major Hazards: the Safe Design, Construction and Use of Plants Producing or Consuming Acrylonitrile, London, Chemical Industries Association, 1991. 23 pp. Accession No: 950617 Reading room 061.5: 66

Construction Plant and Equipment (Harmonisation of Noise Emission Standards) (Amendment) Regulations 1995, London, HMSO, 1995. 3 pp. Accession No: 950662 A 100 SI 1995/2357

Contaminants Entering the Sea: a Report on Contaminant Loads Entering the Seas Around England and Wales 1990-1993, London, HMSO, 1995. 94 pp. Accession No: 950356 West Gallery 628.19:628.394

Contaminated Land Policies: Reprinted from *Chemistry & Industry*, July 1995 Issue No. 13, pp. 481-532 Accession No: 950378 Reference Shelves REF 628.5:332.368 R

Digest of Environmental Statistics, 17th edition, London, HMSO, 1995. 213 pp. Accession No: 950354 Reference Shelves REF 628.5:502.3

EARA Register of Environmental Auditors, London, Earthscan Publications, 1995. 237 pp. Accession No: 950442 Reference Shelves REF 058.7:628.5 R

ENDS Directory of Environmental Consultants, 4th edition, London, Environmental Data Services (ENDS), 1995. 362 pp. Accession No: 950362 Reference Shelves REF 058.7:628.5:06.058.6 R

Environment Act 1995 (Commencement No. 1) Order 1995, London, HMSO, 1995. 4 pp. Accession No: 950666 A 100 SI 1995/1983(C.40)

Environment Act 1995: Chapter 25, London, HMSO, 1995. 394 pp. Accession No: 950661 Reference Shelves REF 628.5:328.34 R

Environment Act 1995: Transfer of Property, Rights and Liabilities from Waste Regulation Authorities to the Environment Agency, London, HMSO, 1995. 30 pp. Accession No: 950660 Reference Shelves REF 628.5 R

Environmental Effects of Heavy Elements: Hydrido and Organo Derivatives, Thayer, J.S., New York, VCH, 1995. 145 pp. Accession No: 950443 Reading Room 546:62-183.2:628.5

Environmental Protection Act 1990 (Commencement No. 17) Order 1995, London, HMSO, 1995. 9 pp. Accession No: 950667 A 100 SI 1995/2152(C.43)

Europe's Environment: the Dobris Assessment, Commission of the European Communities 1995. 676 pp. Accession No: 950691 Reference Shelves REF 628.5(4) R

European Environmental Markets: Environmental Regulation in Eight Western European Countries, London, DTI, 1995. 112 pp. Accession No: 950694 Reference Shelves REF 628.5:331.14 R

Guidance for Chief Executives on Responsible Care, London, Chemical Industries Association, 1992. 16 pp. Accession No: 950600 Reading room 061.5: 66

Guide to Environmental Analytical Methods, 2nd edition, Wagner, R.E. *et al* (eds.), New York, Genium Publishing Corp, 1994. 228 pp. Accession No: 950391 Reference Shelves REF 543:628.5 R

Handbook of Environmental Analysis, 2nd edition, Smith, R.K., New York, Genium Publishing Corp, 1994. 422 pp. Accession No: 950392 Reference Shelves REF 543:628.5 R

Her Majesty's Inspectorate of Pollution 1994-95 Annual Report, London, HMSO, 1995. 162 pp. Accession No: 950679 Reading Room 06.055.5:628.515

IAWQ Yearbook 1995-96, London, IAWQ, 1995. 165 pp. Accession No: 950495 Reference Shelves REF 058.7:621.6.031 R

Industrial Waste Management: a CEFIC Approach to the Issue, 2nd edition, Brussels, CEFIC, 1992. 25 pp, Accession No: 950591 Reading room 061.5: 66

Industrial Water Treatment: Refining, Petrochemicals and Gas Processing Techniques, Berne, F. *et al*, Houston, Gulf Publishing, 1995. 248 pp. Accession No: 950519 West Gallery 628.16

Inter-Company Collaboration for Chlorine Emergencies, London, Chemical Industries Association, 1992. 15 pp. Accession No: 950601 Reading room 061.5:66

International Directory of Emergency Response Centres, France, OECD, 1991. 78 pp. Accession No: 950418 Reference Shelves REF 058.7:628.5 R

The Management of Wastes at Production Sites, London, Chemical Industries Association, 1989. 10 pp. Accession No: 950594 Reading room 061.5: 66

Mersey Estuary: a Report on Environmental Quality, Bristol, NRA, 1995. 44 pp. Accession No: 950400 West Gallery 628.5:626.881

Methods for the Isolation and Identification of Human Enteric Viruses from Waters and Associated Materials 1995, London, HMSO, 1995.35 pp. Accession No: 950541 Basement 543.3P

National Rivers Authority: River Pollution from Farms in England, London, HMSO, 1995. 35 pp. Accession No: 950355 West Gallery 628.19:631.8

New World Water 1995: The International Review of Water and Wastewater in Developing Markets, Harris, R. (ed.) London, Sterling Publications Ltd, 1995. 184 pp. Accession No: 950357 West Gallery 621.6.031

Pesticides in Major Aquifers, Bristol, NRA, 1995. 24 pp. (WRc plc: R&D Report 17) Accession No: 950353 West Gallery 632.95:628.112

Pollution in the UK, London, Sweet & Maxwell, 1995. 218 pp. Accession No: 950548 West Gallery 628.52

The Responsible Use of Landfill, 2nd edition, London, Chemical Industries Association, 1992.16 pp. Accession No: 950593 Reading room 061.5: 66

Spectroscopy in Environmental Science, Clark, R.J.H. *et al* (eds.), Chichester, John Wiley, 1995. 462 pp. Accession No: 950539 Reading Room 543.42:678.5

This Common Inheritance 1995: UK Annual Report: Reporting on the UK's Sustainable Development Strategy of 1994, London, HMSO, 1995. 190 pp. Accession No: 950358 West Gallery 628.5 (41)

The Use of Waste Disposal Contractors, London, Chemical Industries Association, 1990. 11 pp. Accession No: 950595 Reading room 061.5: 66

Volatile Organic Compounds in the Atmosphere (RSC Issues in Environmental Science and Technology No. 4), Hester, R. *et al* (eds.), Cambridge, Royal Society of Chemistry, 1995. 140 pp. Accession No: IEST954 location C 23A

Waste Management Licensing (Amendment No. 2) Regulations 1995, London, HMSO, 1995. 3 pp. Accession No: 950665 A 100 SI 1995/1950

Water Pollution Incidents in England and Wales - 1994: Report of the National Rivers Authority July 1995, London, HMSO, 1995. 58 pp. Accession No: 950659 West Gallery 628.19

Water Quality - Determination of Cadmium by Atomic Absorption Spectrometery, London, BSI, 1995. 14 pp. Accession No: 950463 West Gallery 626.881

Water Quality: Part 2 Physical, Chemical and Biochemical Methods: Section 2.49 Determination of Aluminium - Spectrometric Method Using Pyrocatechol Violet, London, BSI, 1995. 5 pp. Accession No: 950375 West Gallery 626.881

Water Quality: Part 2 Physical, Chemical and Biochemical Methods: Section 2.50 Determination of pH, London, BSI, 1995.10 pp. Accession No: 950434 West Gallery 626.881

RSC Environmental Chemistry Group

COMPETITION

The Group received a good response to its essay competitition for younger members, details of which were given in the previous two issues of this Newsletter.

The two winners will be announced at the Group's Annual General Meeting to be held in conjunction with our 1995/1996 Distinguished Guest Lecture. This meeting wll take place on **Thursday March 7th 1996** at 2.00 p.m. in the **Scientific Societies' Lecture Theatre,** Burlington Place, off Saville Row, London.

RSC Environmental Chemistry Group: Officers (1995)

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