

SAFETY & LOSS
PREVENTION
SUBJECT GROUP

S & LP SG *Newsletter*

ISSUE 5

SUMMER 1995

AN OPPORTUNITY TO INDULGE YOUR FAVOURITE PURSUIT?

The S & LP SG has recently run a highly successful workshop on the management of change and have another one on the stocks for September 1995 covering HAZOPs. This is already fully booked.

We are now looking to make these workshops a regular feature of our programme, but to do so we need leaders who have a consuming passion for their topic. (We would settle for those who are, at least, very keen!)

If you have a yen to further the interests of your own particular subject and would like to do so through the medium of one of our workshops, then why not drop me a line? Your help would be greatly appreciated and, of course, you would have the backing of the resources of the subject group. Emergency planning has been floated as a possibility, but any safety related topic would be considered. The floor is yours.

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THE SAFETY AND LOSS PREVENTION SUBJECT GROUP: (S & LP SG) OF THE IChemE

Your committee thought that a summary of the Subject Group's purposes and activities would be useful, particularly to non-members who may see this Newsletter.

In the IChemE strategy Document we state "Chemical Engineers give safety, loss prevention and environmental protection priority in all their professional activities, which include....."

The aims of the Subject Groups, in general, are "to promote and advance their individual areas of chemical and process engineering, both through industry and academia. They aim to facilitate the exchange of ideas and information between people with a common interest be they engineers, scientists, academics or professionals from related disciplines." This latter statement, taken from the IChemE Subject Group leaflet,

should make it plain that Subject Group membership is open to all interested parties: nothing could be further from the concept of the "closed shop" or special interest group which promotes restrictive practice.

The S & LP SG is now 26 years old and one of the largest and most active of the IChemE Subject Groups. We hold ~ 4 one day meetings a year around the UK and charge a small fee for each, which covers the cost of the meeting and refreshments. We also issue two Newsletters per year - but presumably if you are reading this you already knew that! To find out more about the Subject Group, contact Mike Carpenter, the Subject Groups officer at the IChemE, 44 (0) 1788 - 578214 (phone) or 560833 (fax). The annual subscription is £5.

ASPECTS OF SAFETY TRAINING

This was the theme of a recent meeting of the S&LP SG held at Courtaulds, Coventry on 23rd May. Whilst we could not hope to cover such a broad subject in detail in a one-day meeting, the objective was to dip into a wide variety of aspects 'from the cradle to the grave'.

One of the highlights was a presentation by Sue Fortunka of the IChemE on the new "Health and Safety Activities Box." This is designed to help teachers in primary schools to introduce the idea of risk assessment in an exciting and interesting way to 5-8 year olds. The box is packed full of games and other activities, and may well prove to be useful to a much wider age group! (Full details of the "Health and Safety Activities Box" are described

elsewhere in this Newsletter - Editor).

Other papers presented views on the topic from industry, the universities, the HSE and the IChemE.

Although the audience of about 30 was not large by current standards, the delegates represented a very wide range of backgrounds, which led to a vigorous debate - particularly on the need to improve awareness of safety amongst university graduates!

The meeting also included a brief Annual General Meeting of the S & LP SG at which the Chairman, Gordon Atkinson and Treasurer, Robert Thornton were able to report that the Group is in robust health.

ABOUT IChemE'S REGISTER OF SAFETY & ENVIRONMENT PROFESSIONALS

Society's increasing interest in, and emphasis on, safety, health and the environment is fully appreciated within the chemical and process industries and by the Institution of Chemical Engineers. It is important that those working in these areas are recognized for their professional expertise, particularly as Chemical Engineers often make important contributions to safety and environmental protection.

The IChemE wished to mark the technical and ethical contribution of those people within its membership who have professional standing in these areas above and beyond the normal requirements at Corporate Member level and hence established the Register of Safety and Environment Professionals. Inclusion on this Register also allows recognition by others of their expertise.

The Register is therefore an indicative list of Chartered Chemical Engineers who have been judged by their peers to be suitably qualified by education, training and experience to take on responsibility for, and to advise others on, matters concerning process safety or environmental protection. It enables a variety of groups, including industry, regulatory bodies and the general public easily to identify suitably qualified people who are able to give advice.

The Register is open to Corporate Members and other qualified engineers or scientists who are Companion Members of IChemE.

There are two classes to the Register, one

for Safety and one for the Environment; Registrants can be on either, or both.

To be eligible to join the Register applicants must spend an appreciable percentage of their work activities actively involved in process safety and/or environmental protection. In addition applicants must have held a position of responsibility in this area for at least three years and have been actively engaged in this work in the twelve months prior to their application. An annual declaration is required that members are still active in the field and every five years an updated, attested declaration of their continuing involvement in the field is required. Currently there are 74 members of the Safety Register and 9 members of the Environmental Register, with 6 people on both Registers.

An annual meeting of the Registrants is held and is typically a joint meeting with the Royal Society of Chemistry at which a number of talks on a theme are presented by members of both organisations. The most recent meeting was held in December at Birmingham and took the proposed COMAH Regulations as its topic. In addition the Register's Board meets once a year to discuss policy relevant to the Register.

Anyone who is interested in joining the Register should contact the Membership department at the IChemE for further details.

Mrs Sue Barnett - Accreditation Officer - 44 (0) 1788 - 578214 or 560833 (fax)

BRAIN TEASERS, PAST AND PRESENT:

Readers may recall the Spring 1995 Brain Teaser which was sent in by Trevor Kletz:

A PROBLEM ABOUT PRESSURES

A man had to export a liquid in drums to the tropics. He knew that vapour pressures over liquids increase with temperature and that liquids expand on heating. The extremes in temperature which the drums could experience were 0°C and 30°C. He asked his physical chemistry colleagues (without telling them why, and they, mistakenly, did not ask) to measure the vapour pressure of the liquid at 0°C, 15°C and 30°C and to measure the expansion of the liquid from 0°C to 30°C. The results came back:

Temperature/°C	0	15	30
Vapour pressure/psia	3	6	12
Expansion 0°C to 30°C	3%		

He therefore decided, to be on the safe side, that the drums would be filled to 90% of their volume to allow plenty of room for expansion, and that he would use drums with a bursting pressure of twice the vapour pressure of the liquid at the highest temperature it would experience, i.e $2 \times 12 = 24$ psia.

It was a cold day (0°C) when the drums were filled but he thought this had been allowed for in his margins of safety.

He was very surprised to learn that all the drums had burst when the ship arrived in the tropics.

Explain why this happened.

PROBLEM SOLUTION

The drum is filled at atmospheric pressure. On closure at 0°C the vapour pressure above the liquid will be 3 psia and the partial pressure of air will be $14.7 - 3 = 11.7$ psia.

At 30°C the vapour space will have fallen from 10% to 7.3% of the drum size. The partial pressure of the air will therefore have risen to:

$$11.7 \times \frac{10}{7.3} \times \left(\frac{273+30}{273} \right) = 17.79 \text{ psia}$$

The vapour pressure above the liquid will have increased to 12 psia giving a total pressure of 29.79 psia. Hence the drum failure.

From a number of potentially winning solutions your editor picked that submitted by your erstwhile Subject Group Secretary, Simon Turner, as the best. His prize is free registration at one of our Subject Group meetings - guaranteed not to disrupt life as much as winning £20m on the National lottery. Jim Bickerton ran Simon a close second.

CURRENT BRAIN TEASERS

The "Brain Teaser" for this issue of the Newsletter was submitted by another well known member of the S & LP SG. It is based on a real dichotomy of opinions.

RELIEF DILEMMA?

A pressure vessel to contain about 10 tonnes of LPG is being designed by Simple Simon (No relation to the editor!) He would like to increase the margin of safety by being able to reduce the pressure inside the vessel if the relieving pressure is reached during a fire.

Simple Simon thinks this can be done easily by using a relief line but still approaches his colleague, Tim Dim, for guidance on the pressure reduction measures he might employ. Tim Dim says "Pressure reduction for a fire engulfed pressure vessel cannot be achieved. The LPG will be boiling when the relief valve lifts so it does not need any more heat to vaporise it. If you try to reduce the pressure, vapour will keep flashing off and you will not be able to reduce the pressure until the fire stops or all the LPG has been removed."

Simple Simon could not resolve his problem because he was unsure of his facts but still thinks he should be able to reduce the pressure once the relief valve lifts.

Who is right, and why?

Our usual prize goes to the most lucid, and brief, answer.

THE EUROPEAN PROCESS SAFETY CENTRE (EPSC)

Your committee decided that it would be a good idea to invite Bernard Hancock, International Coordinator of the EPSC, to bring all Subject Group members up to date on what the centre is and what its current and future work plans are: here's what Bernard wrote.

INTRODUCTION

EPSC is well into its fourth year and, with a membership of 36 organisations, has established a reputation for independent, technical process safety knowledge not only in Europe but worldwide.

Below are extracts from our third Annual Report on some of the work being undertaken on behalf of our members.

INFORMATION AND PUBLICATIONS

The Centre has issued a total of 70 *Information Sheets*. These brief notes give an awareness of sources of information or activities and an appreciation of their relevance.

EPSC's first book, "Safety Management Systems - Sharing Experiences in Process Safety Management" is a bestseller and is now in its first reprint.

RESEARCH AND DEVELOPMENT

Five new topics were chosen by the sponsors early in 1995 as subjects for future EPSC reports:

- *Performance measurements in process safety management*
- *Risk management of ageing process plant*
- *Safety-critical systems for process plant & their management*
- *Use of data on past incidents on process plant including, in particular, use to aid hazard identification and control*
- *Hazard identification for programmable electronic systems on process plant*

“*Performance measurements in process safety management*” is being addressed by the EPSC Safety Management Systems subcommittee.

Overview Reports have been commissioned on *Risk management of ageing process plant* from DNV Industry UK Ltd, and both *Safety-critical systems* and *Use of data on past incidents* from AEA

Technology. All three projects include the wide circulation of a questionnaire as well as a literature search and the application of the contractor’s own expertise.

The scope of the possible fifth report, on *Hazard identification for programmable electronics systems*, is being developed in consultation with the sponsors.

FUTURE LEGISLATION AND REGULATIONS

The EPSC has continued to assist the European Commission Directorate General XI in its considerations of future legislation, through participation in the DGXI Working Groups on:

- Safety Reports
- Major Accident Prevention Policies and Management Systems, including Auditing

- Inspection (of management systems, etc. by the Competent Authorities)

and through participation in the CEC DGXI Seminar on:

- Runaway Reactions

EPSC member companies are cooperating with the UK Health & Safety Executive in a benchmark exercise on auditing. It is also intended to benchmark amongst the member companies to develop generic elements and identify best practice.

The EPSC subcommittees set up to advise the EPSC representatives to DGXI have also yielded valuable exchanges of knowledge and information between EPSC members.

WORK

The following Overview Reports will be issued to sponsors by Summer 1995:

- *Risk management of ageing process plant*
- *Safety-critical systems for process plant & their management*
- *Use of data on past incidents on process plant including, in particular, use to aid hazard identification and control*

Following the decision of the sponsors, proposals will be developed to commission reports on:

- *Hazard identification for programmable electronic systems on process plant*
- *More accurate reliability data*
- *Mitigation of gas dispersion*
- *Fire protection of liquefied gas storage and prevention of BLEVEs*

The Centre will explore how best to interact with the European Commission DGXII and JRC, Ispra, on research matters.

FURTHER DETAILS

The extracts only show a small part of our ongoing work in process safety. The full story is available in our latest Annual Report published in June 1995.

Membership is open to manufacturing companies, research institutes, insurers and universities. If you would like a copy or want to know about the Centre contact:

**Bernard Hancock - International
Coordinator**

**European Process Safety Centre (EPSC)
165-189 Railway Terrace**

Rugby

Warwickshire CV21 3HQ

UK

Tel: + 44 (0) 1788 534409/578214

Fax: + 44 (0) 1788 551542/560833

GRADUATE EMPLOYMENT WORKSHOPS

BACKGROUND

Late in 1992 the Institution of Chemical Engineers' Council asked the Professional Development Committee to set up a small Task Force to look into the issue of unemployment amongst Graduate members.

The Unemployed Graduate Task Force was created to look into the ways in which IChemE could provide some form of support for newly qualified Chemical Engineering students.

The group consists of representatives from industry, employees, the IChemE and the National Committee of Non-Corporate members.

WORKSHOPS FOR UNEMPLOYED GRADUATES

The overall aim of the workshops is to allow candidates to receive a structured, in-depth training day based on the recruitment and assessment methods used by real employers. This is to allow them to gain the skills needed to find and secure a job.

The workshops aim to allow candidates to:

- Gain experience of "real-life" interviews carried out by engineering staff
- Give a presentation and answer questions on it
- Receive feedback on their performance and guidance on any areas which may lead to better chances of gaining a position
- Have an opportunity to discuss job hunting and recruitment skills with staff who are responsible for recruitment
- Be given advice and guidance on completing application forms/CVs.

The requirements of the host companies will be provision of meeting and lunch facilities, staff experienced in recruitment, and travel expenses for candidates (within reason).

The Professional Development Area of IChemE are currently seeking companies which employ chemical engineers to host workshops throughout the UK. If you, or contacts within your company, are able to assist or would like further information, please contact Karen Allman, Education Liaison Officer, IChemE, 165-189 Railway Terrace, Rugby CV21 3HQ, telephone: 44 (0) 1788 - 578214, fax: 44 (0) 1788 - 560833.

HEALTH AND SAFETY ACTIVITIES BOX

The Institution of Chemical Engineer's "Health and Safety Activities Box" was launched by Eric Forth, Minister of State for Education, at the House of Commons on Thursday 6th April 1995. This unique, educational resource for children aged 5 - 11 years contains over 100 'ready-to-use', practical activities, which introduce children to the ideas of "risk", "hazard" and "risk management".

The development of the 'Health and Safety Activities Box' was the direct result of feedback from IChemE members working in industry. They felt that educational materials were needed to teach Health and Safety to school children. As all Health and Safety experts are aware, industry in the UK faces a number of problems on the Health and Safety front as a result of misconceptions by the general public and the unfamiliarity of many school leavers with even the basics of safety and risk control. The additional burden on safety training resources from working with 'freshers' is significant. The communications gap between industry and the public is a serious problem. The longer term impact of this Health and Safety Activities Box should be to contribute towards a balanced and informed attitude which should greatly assist in tackling these problems.

Children from St Matthew's Primary School, Westminster, were presented with the very first Box and happily involved the 100 or so adults that attended the launch in a number of the activities. Eric Forth commented "These materials do not necessarily hand the solutions on a plate, but enable children to set out on their own

path of self discovery. An excellent way to learn." Rex Symons, Commissioner at the Health and Safety Commission, who was also a key speaker at the launch, praised the initiative. Julia Saunders, Headmistress at St Matthew's, stressed what a help the box would prove in teaching the curriculum and, particularly, the personal and social education programme.

The development of the box was sponsored by BNFL, Esso, ICI, the Health and Safety Executive and Commission and Nuclear Electric. Professional primary science advisers at the Northamptonshire Inspection and Advisory Service designed the materials in the box. Health and safety expertise was provided by the Health and Safety Executive and by members of IChemE's own Safety and Loss Prevention Subject Group.

The "Health and Safety Activities Box" builds on the IChemE's highly successful safety training packages for industry and its international "Fascinating Science Campaign." This campaign currently takes the form of three Science Activity Boxes, each aimed at a separate age range, 5-7, 7-9 or 9-11 year olds. All the Boxes provide a collection of ideas and activities that can be conducted by children, either alone or in small groups. All the materials to perform the experiments are included in the Boxes (only easily obtainable items, eg. water, are omitted) and are contained in sturdy, plastic storage boxes. Each Box is accompanied by a Teacher's Book, giving detailed guidance and referencing all the activities to the National Curriculum.

If you would like to purchase a box or would like further information about the IChemE's Health and Safety training packages, please contact Rebecca Harding-Shaffer at the Education Liaison Unit, Institution of Chemical Engineers, Davis Building, 165-189 Railway Terrace, Rugby CV21 3HQ Tel: 44 (0) 1788 - 578214 Fax: 44 (0) 1788 - 560833. Health and Safety Activities Boxes cost £195 + VAT.

AUDITING

The programme for this seminar at ICI, Winnington Hall, Northwich proved to be extremely popular with a capacity registration of 80.

The theme of the meeting (chaired by John Gillett) was based on the principle that all auditing processes are similar and that performance improvement is the outcome of effective auditing. The objectives were to represent different views on the basic theme and to share knowledge and experience to help improve safety audits. These objectives were excellently fulfilled by contributions from Jim Corbridge (HSE), Ian Sims (Zeneca Engineering), Peter Willis (Glaxo operations), Peter Shakeshaft (URENCO), David Mills (Aspinwall and Co), John Cronin (Arthur D Little) and Robin Turney (Eutech Eng. Solutions).

This seminar, and many previous ones became overbooked. Again dozens of late applicants could not be accepted - many enquiries as late as the day before. All applicants must have their registration forms submitted before the advised response date to stand a reasonable chance of being able to attend S & LP SG seminars.

As usual there is a seminar information pack on this meeting available from the IChemE library and information service, 44 (0) 1788 - 578214.

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THE USE OF ACCIDENT DATABASES

A contribution from Dr John Bond, S & LP SG committee member.

In his recent book "Lessons from Disasters", Trevor Kletz states in the Introduction:-

"It might seem to an outsider that industrial accidents occur because we do not know how to prevent them. In fact, they occur because we do not use the knowledge that is available. Organisations do not learn from the past or, rather, individuals learn but they leave the organisation, taking their knowledge with them, and the organisation as a whole forgets."

This observation has serious consequences for the organisation as the result is that lessons have to be relearnt. An old pilot's saying advises:

"Learn from the mistakes of others, you'll never live long enough to make them all yourself."

There is little argument that computers have two great advantages over the human brain, those of storing large quantities of information and retrieving the information quickly. Consequently for organisations to learn from the past the accident data has to be stored electronically. Many companies have databases but are they comprehensive enough to contain all of the lessons they and others have learnt?

An unknown person once said:

"A wise man learns from his own experience, but a wiser man learns from the experience of others"

If the chemical engineering profession is to learn from the experiences of others then we must share the experiences so that all can learn and this can only be done by storing the information electronically. How many companies do this and how many access the information for each project? In

recent years many companies have not maintained their databases due to staff shortage so Trevor Kletz's prediction of repetition of accidents will come true.

Does this have to be? Can we not have a database which combines lessons learnt for all to use and based on accidents in many organisations? There are commercial databases but these are based mainly on short newspaper cuttings which give little information. They have limited value but a comprehensive database with lessons learnt could be of great value to the profession.

Is it a practical proposition to have such a database? The INDEX of the Institution is an attempt to get close to this ideal and with an accident database (shortly to be made available) attached to it there is some possibility of taking a step further. The final step, to include lessons learnt, has yet to be made.

The original concept of the Loss Prevention Bulletin was to share accident information. This has depended to a very large extent on the commitment of the senior managers of companies. Some organisations have given heavily to the Bulletin only to wane when there have been changes at a senior level. Other organisations have refused to give any information at all at the beginning and then later, when a director has retired, have become very free with the release of information. A few companies have taken all the information provided but have never provided information in return. It all depends on the commitment of senior personnel.

Publilius Syrus, Maxim 825 (c.43BC) wrote:

"He is truly wise who gain's from another's mishap."

We might add he is also selfish as he should be sharing his mishaps with others but nowhere can I find a quotation or statement that the committed leader is the one who will share all of his experiences with others.

SCHEDULE OF MEETINGS/COURSES ON SAFETY RELATED TOPICS

Topic/Title	Date/ Duration	Venue	Contact Person/ Phone/Fax/Address
Loss prevention in the oil and gas industry (conference)	11/9/95, 3 days	Aberdeen	Mrs C Cox, BHR, Cranfield, Bedford MK43 0AJ
12 Annual workshop/1st ENCRESS conference on safety and reliability software based systems (conference)	12/9/95, 4 days	Brugges, Belgium	Carol Allen, Centre for software reliability, City University, Northampton Square EC1V 0HB
Assessing and minimising risk in the design, construction of offshore structures (conference)	18/9/95, 2 days	Olympia Hilton, London	IIR Ltd, 29 Bressenden Place London SW1E 5DR
2nd Annual Conference on Preventing and Managing emergencies	26/9/95, 2 days	Forte Crest London	Sarah Ashmore/Liz Hide 0171-637 4383
Managing biological and chemical risks: a strategy for working in biomedical, laboratory and clinical environments (conference)	29/9/95, 1 day	The Wellcome Trust, London	Jonathan Cowie, 20-22 Queensbury Place, London SW7 2DZ
Hazardous Area Technology - Static electricity (course)	9/10/95, 1 day	Bromley Court Hotel, Kent	Sira test and certification
Hazardous area classification (course)	17/10/95, 1 day	Bromley Court Hotel, Kent	Sira test and certification
Major Hazards onshore and offshore (conference)	24/10/95, 3 days	Manchester	Adin Clarke, Huntsman Chemical Co Ltd, 0161-775 5321, fax 777 9532
Prevention preparedness and response to major industrial accidents and environmental releases (conference)	31/10/95, 5 days	Toronto	Major Industrial Accidents Council of Canada, 265 Carling Avenue, Suite 600, Ohawa, Ontario K1S 2E1
15 Annual conference on Risk assessment – Solution, panacea or minefield (conference)	15/11/95, 2 days	Leamington Spa	British Health and Safety Society, BHSS Conference Secretariat, Health and Safety Unit, Aston University, Birmingham B4 7ET
Emergency planning and management (conference)	21/11/95, 2 days	London	IMechE, 1 Birdcage Walk, London SW1H 9JJ
1996 Process Plant Safety Symposium (Conference/Exhibition)	1/4/96, 2 days	Houston	Mr Stan Rubashkin, GDS Engineers, c/o ARCO Chem Co, 2505 Sheldon Road, PO Box 30, Channelview, TX 77503, USA
European Society of Risk Analysis – ESRA 96	3/6/96	Guildford	Mrs J Libaert, Centre for Environmental Strategy, University of Surrey, Guildford, GU2 5XH

The following Continuing Education Courses have been organised by the IChemE. Details are available from the conferences and courses department + 44 (0) 1788 578214 or fax + 44 (0) 1788 577182.

Date	Topic/Title	Venue
11 - 14 Sept 1995	Applied Hazard and Operability study	Altrincham
13 Sept 1995	Screening and quantification of exothermic chemical reactions	Borehamwood
14 Sept 1995	Process scale up and relief sizing for exothermic chemical reactions	Borehamwood
2 - 5 Oct 1995	Introduction to hazard analysis and risk assessment	Sheffield
23 - 26 Oct 1995	Design for safe handling of industrial chemicals *	Sheffield
31 Oct -3 Nov 1995	HAZOP study for team leaders and members	Manchester
3 - 6 Dec 1995	Applied hazard and operability studies	Leeds
13 - 16 Feb 1996	Applied hazard and operability studies	Sheffield
6 - 9 March 1996	Major Hazards and emergency planning *	Sheffield
4 April 1996	Dust explosion hazards	Harrogate
5 April 1996	Industrial electrostatic hazards	Harrogate
6 April 1996	Classification of potentially explosive areas	Harrogate
7 April 1996	Chemical reaction hazards	Harrogate
3 May 1996	Hazard Assessment using the Mond index	London
8 - 11 May 1996	Safety management and loss prevention *	Sheffield
22 - 25 May 1996	Computer control - safe practice in the process industries *	Sheffield
19 - 21 June 1996	HAZOP study and its management	Harrogate
* Can be modules of an MSc in Process Safety and Loss Prevention		

RECENT BOOKS AND PUBLICATIONS

GUIDELINES FOR CHEMICAL REACTIVITY EVALUATION AND APPLICATION TO PROCESS DESIGN

AIChE, 1995, ISBN 0-8169-0479-0, 210 pages, £130.00, available in the UK from IChemE

In 1985 the AIChE set up the Centre for Chemical Process Safety (CCPS) "to provide expert leadership and focus on engineering practices and research that can prevent or mitigate catastrophic events involving hazardous materials," - a worthy objective.

The "Guideline" series of books, now coming off the press regularly, are one product from the CCPS though in this case the TNO Prins Maurits Laboratory in the Netherlands were subcontracted to produce the text on behalf of the CCPS.

The DIERS manual (ISBN 0-8169-0568-1) is probably the most complete guide in this area but its contents are presented in a peculiarly indigestible form: the potential market for this book is therefore considerable.

As I read the text I had the feeling that I was reading a preliminary draft of the book rather than the finished article. Errors of the typographical form are common: I found 10 in the 2 page list of symbols alone! This detracts from what could have been a good and useful publication but in addition the language and explanations often lack precision and rigour.

The four chapter headings are "Introduction," "Identification of Hazardous Chemical Reactivity," "Chemical Reactivity Considerations in Process/Reactor Design and Operation" and "Management of Chemical Process Safety." A good listing of some 300 references and "selected additional readings" (references published too late to be included in the main text?) bring the book to a close. The chapters are split into many short sections : this is useful and means that reading can be accomplished in many brief, self-contained sessions. In addition it makes the text easy to "dip into" to find a particular item of interest. The sections are interspersed with many tables and figures which, again, aid clarity and ease of assimilation.

If this "Guideline" runs to a second edition then I hope that all the unnecessary minor errors and irritations of the text can be removed. If so it will become a valuable book useful alike to practising chemical engineers and students.

Simon Waldram

Technical Director, Hazard Evaluation Laboratory