

IChem^E

**SAFETY & LOSS
PREVENTION
SUBJECT GROUP**

S & L P S G *Newsletter*

ISSUE 7

SUMMER 1996

FROM THE EDITOR

Not all subject group members will have read, or heard, the "Thoughts of Chairman Atkinson." We thought it appropriate to put them on the cover of this issue of the "little red book" so that you know that your subject group is in good health.

*Institution of Chemical Engineers
Safety and Loss Prevention Subject Group
Annual General Meeting, 14th May 1996, London
Chairman's Report, Gordon Atkinson*

The S&LPSG was one of the first subject groups to be recognised by the Institution and this is our 17th AGM.

I am pleased to report on another successful year during which we have continued to pursue our policy of encouraging continuous improvement in Safety and Loss Prevention by bringing topics of the day before as wide an audience as possible at the minimum cost. We are very competitive in this. The membership fee is still £5 and costs for our full day seminars are around £40 - £45. Our success is reflected in the size of membership - just short of 500 by the end of the year.

Once again my thanks go out to our committee for making this possible, particularly the Officers - Robert Thornton the treasurer, Andy Rushton the secretary, Simon Waldram the editor of the Newsletter, and John Bond for his continuous support and encouragement.

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Since the last AGM we have held 4 committee meetings and run 4 seminars, including the highly successful Hazop Workshop, organised by Simon Turner and John Gillett, which has been widely reported in the LPB and TCE. We have continued to support the Institutions's Research Event and TCE's safety and environmental awards, and have made contact, if somewhat tentatively at the moment, with our counterparts in Australia.

With the new organisation of the Institution's governing structure, the Subject Groups are called upon to play an increasingly important role in the way the Institution is run. I should therefore like to end these remarks by thanking the membership for their support and appealing to them for even greater participation in the future. In this way we will ensure the prosperity of both the S&LPSG and the Institution in the future.

*Mr Gordon Atkinson
Chairman of S&LP SG*

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Les Finlayson, Tony Fishwick and Alan Morton of BNFL Springfields describe how they achieved dramatic reductions in accident rates at this site by using an audit of safe and unsafe behaviour.		<i>TWO BURSTING DISCS ONE HOLDER</i>	16
<i>INCINERATOR OVERHEATS</i>	7	During routine two-yearly inspections, it was discovered that two bursting discs had been installed in one holder. No direct losses resulted but the consequences were serious as this approximately doubles the relief pressure.	
An incinerator overheated due to the sudden influx of flammable vapour causing burning and flammable material to enter the cooling chamber damaging the cooling duct, expansion bellows and induction fan.		<i>NEAR-MISS INCIDENTS IN DRYERS</i>	18
<i>INCORRECTLY INSTALLED BURSTING DISC LED TO ETHYLENE FIRE</i>	8	Two cases where problems were spotted before they caused losses.	
A bursting disc was fitted in the reverse direction and ruptured prematurely releasing cracked gas and quench oil to atmosphere which then ignited.		<i>FAILURE OF BACKUP SYSTEMS</i>	21
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Residual heat in the refractory lining of the kettle was enough to cause the first explosion and fire. After removal of the extinguishing system there was a second explosion.		<i>EVENTS</i>	23
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LESSONS I DID NOT EXPECT TO LEARN

THE FIRST IN A SERIES BY

MARTIN PITT

One of the pleasures of attending meetings of the Safety and Loss Prevention Subject Group is that you tend to learn so much more than was in the programme. The discussions which take place after the presentations (and over lunch or coffee) draw on an enormous range of professional experience and may provide quite unexpected illumination on all sorts of safety-related matters.

We can also learn by observing, as the following cases may illustrate. They all happened on the occasion of S&LPSG meetings. This is the first.

A modernized lecture theatre had 3-position dimmer switches for the lights, to give two lower levels of illumination. These probably worked by dropping the voltage, most likely by putting resistors in series. This was doubtless fine when originally installed with tungsten filament lamps, which get substantially dimmer as you reduce the voltage, by a curve something like the fourth power. For example, 85% of the voltage gives about 50% of the light. However, the theatre had been improved by replacing the lights with fluorescent units. These do not have the same characteristic, being more nearly linear, so the first switch position only reduced the illumination a bit. However, a fluorescent tube does require a certain minimum voltage of

around 120V in order for current to pass at all, which is known as the 'striking voltage.' The second switch position dropped the voltage below the level at which the lamps strike, so they went out altogether! (Fluorescent lights can be dimmed, but require a more complex circuit). It was therefore not possible to get the levels of illumination suitable for showing overheads and slides clearly.

There were two lessons here. First, this was an example of a plant modification (doubtless with the laudable aim of improving energy usage) which had not been fully thought through by someone with sufficient technical knowledge.

Electricians had been instructed to replace tungsten lights with fluorescent tubes, but the switches had not been changed to match. (The electricians almost certainly would have realised what was needed. Did they just obey orders, or were they disregarded?) Secondly, this modification had been in place for some years, and people had just put up with it! Did no-one notice that the lecture theatre was now less functional, or was the administrative system not responsive to complaints? Did an educational institution think that a good teaching environment was unimportant?

Martin Pitt - University of Sheffield

S & LP SG ACTIVITIES – “IN THE PIPELINE”

- | | |
|--------------------|---|
| October 14 1996 | Inherent Safety Workshop
Zeneca, Alderley Edge
Organiser : Allen Ormond |
| November 20th 1996 | Explosions and runaway reactions
(joint with London and South Eastern Branch)
SCI, Belgrave Square
Organiser : Simon Waldram |
| January 1997 | Crisis management
SCI, Belgrave Square
Organiser : John Bond |
| March 12th 1997 | Corporate liability seminar
Foster Wheeler, Reading
Organiser : Geraldine Woollatt |
| June or later 1997 | Safety implications of fluids separation processes & AGM
(joint with Fluids Separation Subject Group) Sheffield
Organiser : Martin Pitt |
| June or later 1997 | Brewing safety
Location not finalised
Organiser : John Atherton |
| September 1997 | Safety versus environment?
Wirmington Hall
Organiser : Don Willats |
| 1997 | Importance of following up safety recommendations
(possibly joint with I MechE, IEE?)
Location not finalised
Organiser : John Bond |

For information about any of these meetings please contact the Subject Group Secretary.

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The IChemE library at Rugby have recently acquired a number of publications in the Safety and Loss Prevention field. Details are as below. If you would like more information then please call Helena Perrin on 01788 -578214.

1. AICHE & CCPS. <i>Guidelines for Chemical Reactivity Evaluation and Application to Process Design</i> (AICHE, 1995) 614.8 AME	9. Forsberg K & Keith LH. <i>Chemical Protective Clothing</i> (Lewis Publishers, 1995) 614.8 FOR
2. AICHE & CCPS. <i>Guidelines for Process Safety Fundamentals in General plant Operations</i> (AICHE, 1995) 614.8 AME	10. Furr AK. <i>CRC Handbook of Laboratory Safety</i> (CRC Press, 1995) 542 FUR
3. AICHE & CCPS. <i>Guidelines for Safe Operations and Maintenance</i> (AICHE, 1995) 614.8 AME	11. IBC. <i>Dust Explosions</i> (IBC, 1995) Conference
4. AICHE & CCPS. <i>Guidelines for Safe Storage and Handling of Reactive Materials</i> (AICHE, 1995) 614.8 AME	12. Jones RB. <i>Risk Based Management - a Reliability Centred Approach</i> (Gulf Publishing, 1995) Reference - 658.5 JON
5. AICHE & CCPS. <i>Guidelines for Technical Planning for on-Site Emergencies</i> (AICHE, 1995) 614.8 AME	13. Mewis JJ. <i>Proceedings of the 8th International Symposium on Loss Prevention and Safety Promotion in the Process Industries</i> (Elsevier, 1995) Conference
6. AICHE & CCPS. <i>International Conference and Workshop on Modelling and Mitigating the Consequences of Accidental Releases of Hazardous Materials</i> (AICHE, 1995) 614.8 AME	14. National Research Council. <i>Prudent Practices in the Laboratory</i> (National Academy Press, 1995) 542 NAT
7. Bretherick L & Urben PG. <i>Handbook of Reactive Chemical Hazards, Fifth Edition</i> (Butterworth Heinemann, 1995)	15. Rodgers BR & Petry FS. <i>Expert Systems in Process Safety</i> (AICHE/CCPS, 1995) 614.8
8. Clayton GD & Clayton FE. <i>Patty's Industrial Hygiene and Toxicology, Volume III, Part B</i> (John Wiley & Sons, 1995) Reference	16. Strong CB. <i>Emergency Response and Hazardous Chemical Management - Principles and Practices</i> (St Lucie Press, 1996)
	17. Wilson DJ. <i>Concentration Fluctuations and Averaging Time in Vapour Clouds</i> (AICHE/CCPS, 1995) 614.8 AME

FINDING THAT KEY PUBLICATION

Literature surveys are so easy these days: type in a few keywords and get a printout of everything published on a given topic. Right? Not so I'm afraid. John Bond recently sent me a table which is reproduced below. A number of databases are listed in the columns and in the rows are indicated the number of papers abstracted from particular sources. The very poor coverage of many sources, particularly IChemE Symposia series, shows how incomplete a computer based literature survey may be. Be warned!

PUBLICATION	NUMBERS OF PAPERS COVERED BY DATABASE							
	Papers Published to Dec 95	INDEX to Dec. 95	HSELINE to Dec. 95	CEABA to Dec. 95	ECHS to Dec. 95	CISDOC to Dec. 95	NIOSH TIC to Dec. 95	BIDS Compendex 1980 - 96
Loss Prevention Bulletin	699	699	444	324	700	60	1	0
Environmental Protection Bulletin	202	202	86	127	166	0	0	0
Chemical Engineering Research and Design Transactions Part A	Many	-	1	92 in German 105	13	0	0	253
Process Safety and Environmental Protection. Transactions Part B	216	216	10	110	123	0	0	116
Chemical Engineering Research and Design	Many	-	3	269	30	1	3	654
Effluent Treatment and Waste Disposal. Symposium. Series No: 116	30	-	0	0	1	0	0	0
Occupational Hygiene and Environmental Issues. 1990 Symposium Series No. 117	23	-	4	0	1	1	0	0
Hazards Symposium XII	43	-	16	0	0	1	0	0
Hazards Symposium XI	29	-	3	0	0	0	0	0
Hazards Symposium X	27	-	7	0	0	0	0	0
Hazards Symposium IX	20	-	5	1	1	0	0	0
Hazards Symposium VIII	25	-	0	0	0	0	0	0
Hazards Symposium VII 1980	22	-	13	0	0	0	0	0
Hazards Symposium I to VI	Many	-	0	0	0	0	0	0
8th International Symposium on Loss Prevention in Antwerp. 1995	123	-	0	1	1	0	0	0
7th International Symposium on Loss Prevention in Taormina. 1992	171	-	3	45	1	0	0	0

PUBLICATION	NUMBERS OF PAPERS COVERED BY DATABASE							
	Papers Published to Dec 95	INDEX to Dec. 95	HSELINE to Dec. 95	CEABA to Dec. 95	ECHS to Dec. 95	CISDOC to Dec. 95	NIOSH TIC to Dec. 95	BIDS Compendex 1980 - 96
6th International Symposium on Loss Prevention in Oslo. 1989	119	-	7	0	1	0	0	0
5th International Symposium on Loss Prevention in Cannes. 1986	70	-	7	0	1	0	0	6
4th International Symposium on Loss Prevention in Harrogate. 1983	96	-	10	1	1	0	7	0
Management of Safety 1995	6	-	1	0	0	0	0	0
Management of Safety 1993	6	-	2	0	0	0	0	0
Management of Safety 1991	10	-	0	0	0	0	0	0
Management of Safety 1989	7	-	0	0	0	0	0	0
Management of Safety 1987	8	-	2	0	0	0	0	0
Management of Environmental Protection 1994	8	-	0	0	0	0	0	0
Management of Environmental Protection 1993	6	-	0	0	0	0	0	0
Hazards from Pressure Symposium Series No. 102	21	-	3	1	1	0	0	0
Preventing Major Chemical and Related Process Accidents. 1988 Symposium Series No. 110	57	-	1	0	0	0	0	0
Safety and Loss Prevention in the Chemical and Oil Processing Industries Symposium Series No. 120	54	-	1	0	0	0	0	0
Piper Alpha - Lessons for Life-cycle Safety Management. 1990 Symposium Series No. 122	14	-	2	1	0	0	0	0
Major Hazards Onshore & Offshore 1992 Symposium Series No. 130	45	-	16	0	1	1	0	0
Effluent Treatment and Waste Minimisation. 1993 Symposium Series No. 132	20	-	0	0	0	0	0	0
Major Hazards Onshore & Offshore II 1995 Symposium Series No. 139	45	-	0	0	1	0	0	0

BRAIN TEASERS, PAST AND PRESENT:

PAST:

Our last brain teaser was in two parts:

- i) If i is the square root of -1 then what is the i th root of i ?
- ii) The year 1961 was called topsy turvey because it looked the same upside down. 1991 was the last palindromic year. What is the next year which is both topsy turvey and palindromic?

I won't reveal the name of the gentleman (?) whose answers were

- i) 42 (Ref: 1)
- ii) 6996 (Ref: 2)

Ref 1: The hitchhikers guide to the galaxy

Ref 2: Karma Sutra

The correct answers are $\exp(\pi/2)$ (strange that a purely imaginary root of a purely imaginary number should be real?) and 8008.

Wearing my judges hat I award our usual prize of free registration at a S & LP SG one day meeting to Ceri Thomas of Newson Gale Ltd. Fred Wilson, a safety engineer with Courtaulds Chemicals, ran him an agonizingly close race but was just pipped on the line.

PRESENT:

The new brain teaser is, I think fairly straightforward, but not quite as trivial as it looks. I saw it in the newsletter from the Accountancy firm of H W Fisher and company and have borrowed it unashamedly.

A man with a house on a stretch of tidal river occasionally uses a boat equipped with an outboard motor to visit a nearby riverside pub. The pub is two kilometres away and the man finds that with the current the trip takes two minutes. When he makes a return trip against the same current the trip takes four minutes. How long will it take to make the trip at slack water when no current is running?

Answers should be sent to the editor with a prize for the most original/witty and correct response.

SAFETY AUDITING : THE NEED FOR STANDARDS ***(a personal view) Ron Davies***

The purpose of safety auditing is to ensure that a particular plant or operation is safe as defined by design criteria and according to operating procedures. Safety auditing is the most widely used means of meeting the requirements of the Health and Safety at Work, etc., Act 1974 which obliges employers to ensure “so far as is reasonably practicable” that plant does not represent a risk to employees.

The effectiveness of a safety audit depends on the extent and thoroughness of the audit, the competency of the auditor to interpret the findings in a meaningful way, and the audit follow-up (see T Kletz, *Lessons from Disaster*, p.96). All industrial operations which involve risk to employees are subject to periodic safety auditing but the effectiveness of the audit procedure itself is seldom assessed. An audit tends to be regarded as effective when no accidents occur but this conclusion can provide a false sense of security given the unpredictability of human error. Equally, the ability of the auditor to carry out an effective audit is seldom assessed. What is needed are industry standards against which the effectiveness of safety auditing and the competency of an auditor can be measured.

The extent and thoroughness of safety auditing varies considerably across industry. Auditing involves the use of checklists which are usually generated in-house since a small number only are available from trade, professional or other organisations. The safety of the operation being audited may be assessed qualitatively or quantitatively (e.g. rated). The considerable variation in audit procedure, as well as auditor competency, makes it difficult both to evaluate the effectiveness of the safety audit and to compare the

performance of similar operations within a company and across industry. Only by sharing experiences on an equal basis can industry expect to reduce plant failures and accidents significantly.

Training of the auditor is essential if meaningful and effective auditing is to be carried out. Training courses are provided in safety auditing by various organisations, e.g. the IChemE and Link Associates International. Some of these courses receive approval from professional organisations. Again, there is no standard against which the different courses available can be compared or judged to be effective.

Given the considerable variation in safety auditing procedures and competency of auditors, and the growing importance attached to ensuring safe plant operations in industry, it would seem timely to consider a more uniform, industry-wide approach to auditing procedures. There are considerable benefits in having an industry recognised standard checklist and quantitative audit rating system, such as:

- more effective safety auditing and therefore inherently safer plant
- greater industry recognition of the audit results
- improved safety measures with quantification and implementation industry-wide
- cost savings since less auditing needs to be done by other parties in certain situations (e.g. auditing of warehouses, hauliers, toll manufacturers)
- reducing the effect of inadequate auditor performance

It is suggested that a series of standard safety audit checklists be produced which could be used together in various combinations depending on the type of plant or operation being audited. The checklists would form part of an overall safety management (or risk assessment) system or be used for specific plant audits and are seen as complementary to hazard analysis techniques (e.g HAZOP). The wide range of plants and processes needing auditing does not represent a particular difficulty because of the common approach taken in all safety auditing. A limited number of focused checklists could be designed to adequately serve any plant or operational situation. Such basic checklists would be supplemented by short customised checklists prepared in-house to address a specific plant situation or company auditing requirement (e.g. hazards).

The use of a rating system to assess the performance of the audited plant is necessary in order to achieve meaningful comparisons both within a single company and across industry (e.g. International Safety Rating System). Auditing using the checklists as a basis would be carried out by company personnel (for internal audits) or by an impartial body (e.g. Lloyds) where the results are seen to demonstrate the credibility of a company's operations or are required by customers.

It is suggested that the standard audit checklists be prepared jointly by interested trade, professional engineering and other organisations. Some checklists have previously been prepared by various organisations for members, e.g. BCDTA, CEFIC and UN for warehouses and/or hauliers, and AEA Technology has developed the SAFARI safety and regulatory inspection system. The proposed standard checklists would serve

as peer reviewed documents, providing guidance to industry on good safety auditing practice.

The auditing procedure is very dependent on the competency of the auditor and hence a standard training course for auditors involving certification by examination appears to be a necessary component of an effective safety auditing system. Such a course could be run on a similar basis to the NEBOSH course for health and safety training. The elements of a certificated course could come from one or more of the auditor training courses currently run, e.g. by the IChemE. It is proposed that a joint committee be set up involving various interested trade, professional engineering and other organisations to prepare and monitor such a course and to set an appropriate examination.

The author would be interested in the views of readers regarding the concept of standard audit checklists and auditor certification. It should be mentioned that the use of standard audit checklists is increasing. For example, the Safety Quality Audit System (SWAS) for the auditing of hauliers, prepared by the European Council of Chemical Manufacturer's Federations (CEFIC) in response to requests from industry. CEFIC are currently working on similar audit checklist and rating systems for bulk chemical storage facilities, tank cleaning operations and marine cargo handling.

Ron Davies

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(Is this something in which the S & LP SG committee should take a lead role? Readers are invited to respond to Ron Davies directly or via the next issue of the Newsletter). Ed.

The lead article in the June 1996 IOD news (No: 28) published by the Institute of Directors made interesting reading. Under the banner headline, "IOD urges cutbacks to health and safety burden" was the following text.

The IOD has issued a qualified welcome to the Government's commitment to cutting the Health and Safety burden on business, arguing that still more needs to be done.

In a paper entitled "Health and Safety", the IOD sets out a catalogue of problems, highlighting an over-zealous H&S Inspectorate which is putting British firms at a competitive disadvantage.

Referring to the series of "Your Business Matters" conferences earlier this year, at which well over 2,000 small businesses were involved in putting their views across to the Government, the paper recommends a number of courses of action:

- Regulators should use more persuasion and less coercion
 - There should be more co-ordination of regulatory bodies to reduce the scope for inconsistency
 - Civil rather than criminal penalties need to be considered
 - Small business, especially, should be consulted more widely before measures are introduced
- Commenting on the Paper, the IOD's Head of Policy Ruth Lea said it was clear that small businesses bore the brunt of Health & Safety legislation.
- "The "Your Business Matters" conferences clearly showed that the H&S Executive is widely seen as oppressive, both in its legislative programme and in its dealings with business," she said. "Moreover, the steady stream of documentation from the HSE seems unabated.
- "In the first half of this year over 1,400 pages of discussion documents have been sent out, much of which are difficult to understand"
- "We welcome the Government's proposals to reduce the legislative burden on small business and urge their effective implementation."
- EU standards should be applied at the minimum laid down by directives, and there should be no so-called "gold-plating" of EU directives by over-zealous British inspectors
 - There should be increased vigilance at EU level and no more circumvention of the UK Social Chapter opt-out under the pretext of Health & Safety
 - A moratorium on all Health and Safety legislation should be considered in view of the excessive volume of legislation
 - The 40% reduction in legislation proposed in last year's Competiveness White Paper should be enthusiastically supported
 - Employment legislation should be determined by national governments, not by the EU Commission
- Fair comment or ignorant criticism?
Your views would be welcome.**

SCHEDULE OF MEETINGS/COURSES ON SAFETY RELATED TOPICS

Topic/Title	Date/ Duration	Venue	Contact Person/ Phone/Fax/Address
Design for safe handling of industrial chemicals	21/10/96 4 days	Sheffield	Tony Watkins Tel: 01788 578214
Hazardous Area Technology - Static Electricity	22/10/96 1 day	Bromley Court Hotel Kent	Sira Test & Certification Tel: 0181-467 2636 Fax: 0181-295 3005
4th Annual integrated hazard assessment course for the process industries	28/10/96 4 days	Chester	Peter Doran, IChemE, NVVB Tel: 01606 889714
Successful emergency management	29/10/96 1 day	Derby	Katrina Williamson (Link) Tel: 01332 - 677066
Preventing mechanical failure and electrical hazards	04/11/96 4 days	HSE, Sheffield	Tony Watkins, IChemE Tel: 01788 - 578214
HAZOP study for team leaders and team members	05/11/96 1 day	Manchester	Tony Watkins (IChemE) Tel: 01788 - 578214
EHS Auditing	07/11/96 1 day	Manchester	David Gill Tel: 01829 - 732878
Explosion prediction and mitigation	11/11/96 3 days	Leeds	Julie Charlton, University of Leeds Tel: 0113-233 2494 Tel: 0113-233 2511
Explosion and runaway reactions	20/11/96 1 day	SC1 Belgrave Sq	Simon Waldram, HELC Ltd Tel: 0181-441 6778 Fax: 0181-441 6754
Applied Hazard and Operability study	24/11/96 1 day	Harrogate	Tony Watkins, IChemE Tel: 01788 - 578214
Process plant reliability and maintainability	02/12/96 4 days	Sheffield	Tony Watkins, IChemE Tel: 01788 - 578214
Production, process and emergency systems	02/12/96 1 day	Aberdeen	Hellen van der Weide, ESD Simulation Tel: 01224 - 741444
Flammable and toxic gas - hazards and detection	04/12/96 2 days	Bromley, Kent	Sira Test & Certification Ltd Tel: 0181-467 2636 Fax: 0181-467 7258
Manosaf '97	12/02/97 1 day	London	John Bond, Society of Chemical Industries Tel: 01438 - 717253
Jubilee research event	07/04/97 1 day	Nottingham	Julie Morgan, IChemE Tel: 01788 - 578214
Major Hazards XIII	22/04/97 3 days	Manchester	Adin Clarke - Huntsman Tel: 0161-776 5480
Process Safety - the future	22/04/97 3 days	North West Branch Manchester	Adin Clarke Tel: 0161-776 5480 Fax: 0161-777 9532
9th International Symposium Safety as a factor in business and operation	04/5/98 4 days	Barcelona, Spain	EFCE, CCPS