Loss Prevention in the Process Industries
Hazard Identification, Assessment and Control
Volume 1, 2, 3
Second edition
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This book is dedicated to
Herbert Douglas Lees (1860–1944), gas engineer;
Frank Priestman Lees (1890–1916), gas engineer;
Herbert Douglas Lees (1897–1955), gas engineer;
David John Lees (1936–), agricultural engineer;
Frank Lyman MacCallum (1893–1955), mining engineer and missionary;
Vivien Clare Lees (1960–), plastic and hand surgeon
Harry Douglas Lees (1962–), restaurateur
and their families

‘They do not preach that their God will rouse them a little before
the nuts work loose.
They do not teach that His Pity allows them to drop their job when
they dam’-well choose.
As in the thronged and the lighted ways, so in the dark and the
desert they stand,
Wary and watchful all their days that their brethren’s days may be
long in the land.’

Rudyard Kipling (The Sons of Martha, 1907)

Wo einer kommt und saget an,
Er hat es allen recht getan,
So bitten wir diesen lieben Herrn,
Er woll uns solche Kunste auch lehrn

(Whoever is able to say to us
‘I have done everything right’,
We beg that honest gentleman
To show us how it is done)

Inscription over the ‘Zwischenbau’ adjoining the Rathaus in Brandenburg-on-the-Haven
(quoted by Prince B.H.M. von Bulow in Memoirs, 1932)

If the honeye that the bees gather out of so manye floure of herbes… that are growing in other
mennis medowes… may justly be called the bees’ honeye… so maye I call it that I have…
gathered of manye good autores… my booke.
William Turner (quoted by A. Scott-James in The Language of the Garden: A Personal Anthology)

By the same author:
A.W. Cox, F.P. Lees and M.L. Ang (1990): Classification of Hazardous Locations (Rugby: Institution of Chemical Engineers)
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Company, Chicago), in particular Booklet No. 4, Safe Ups and Downs of Refinery Units, Copyright 1960 and 1963 The American Oil Company and Booklet No. 9, Safe Operation of Air, Ammonia and Ammonium Nitrate Plants, Copyright 1964 The American Oil Company. Quoted material is used with the permission of the copyright owner.

Professor H.A. Duxbury and Dr A.J. Wilday have been good enough comment on Chapter 17, Sections 17.16–17.21. Professor Duxbury has also contributed Appendix 13 on safety factors in simple relief systems. The responsibility for the text is mine alone.
Terminology

Attention is drawn to the availability in the literature of a number of glossaries and other aids to terminology. Some British Standard glossaries are given in Appendix 27 and other glossaries are listed in Table 1.1.

Notation

In each chapter a given symbol is defined at the point where it is first introduced. The definition may be repeated if there has been a significant gap since it was last used. The definitions are summarized in the notation given at the end of the chapter. The notation is global to the chapter unless redefined for a section. Similarly, it is global to a section unless redefined for a subsection and global to a subsection unless redefined for a set of equations or a single equation. Where appropriate, the units are given, otherwise a consistent system of units should be used, SI being the preferred system. Generally the units of constants are not given; where this is the case it should not be assumed that a constant is dimensionless.
Use of References

The main list of references is given in the section entitled References, towards the end of the book. There are three other locations where references are to be found. These are Appendix 27 on standards and codes; Appendix 28 on institutional publications; and in the section entitled Loss Prevention Bulletin which follows the References.

The basic method of referencing an author is by surname and date, e.g. Beranek (1960). Where there would otherwise be ambiguity, or where there are numerous references to the same surname, e.g. Jones, the first author’s initials are included, e.g. A. Jones (1984). Further guidance on names is given at the head of the section References.

References in Appendices 27 and 28 are by institution or author. Some items in these appendices have a code number assigned by the institution itself, e.g. API (1990 Publ. 421), but where such a code number is lacking, use is generally made of an item number separated from the date by a slash, e.g. IChemE (1971/13). Thus typical entries are:

API Std 2000: 1992 a standard, found in Appendix 27 under American Petroleum Institute
API (1990 Publ. 421) an institutional publication, found in Appendix 28 under American Petroleum Institute
HSE (1990 HS(G) 51) an institutional publication, found in Appendix 28 under Health and Safety Executive, Guidance Booklets, HS(G) series
Coward and Jones (1952 BM Bull. 503) an institutional publication, found in Appendix 28 under Bureau of Mines, Bulletins

Institutional acronyms are given in the section Acronyms which precedes the Author Index.

There are several points of detail which require mention concerning Appendix 28. (1) The first part of the appendix contains publications of a number of institutions and the second part those of the Nuclear Regulatory Commission. (2) The Fire Protection Association publications include a number of series which are collected in the Compendium of Fire Safety Data (CFSD). A typical reference to this is FPA (1989 CFSD FS 6011). (3) The entries for the Health and Safety Executive are quite extensive and care may be needed in locating the relevant series. (4) The publications of the Safety and Reliability Directorate appear under the UK Atomic Energy Authority, Safety and Reliability Directorate. A typical reference is Ramskill and Hunt (1987 SRD R354). These publications are immediately preceded by the publications of other bodies related to the UKAEA, such as the Health and Safety Branch, the Systems Reliability Service and the National Centre for Systems Reliability.

References to authors in the IChemE Loss Prevention Bulletin are in the style Eddershaw (1989 LPB 88), which refers to issue 88 of the bulletin.