

Contents

Foreword	v
Acknowledgements	vii
1 Introduction	1
1.1 Aims and objectives	1
1.2 Essential features of HAZOP study	2
2 Process hazard studies	4
3 The HAZOP study method	8
3.1 Essential features	8
3.2 The purpose	9
3.3 Limitations	9
4 The detailed HAZOP study procedure	11
4.1 The description and design intention	11
4.2 Generating a deviation	13
4.3 Identifying causes	16
4.4 Evaluating consequences	17
4.5 Safeguards (protection)	17
4.6 Risk assessment	18
4.7 Recommendations/actions	19
4.8 Recording	20
4.9 Continuing and completing the analysis	20
4.10 An illustration of the HAZOP study process	20
5 Organizing a HAZOP study	28
5.1 Defining the scope and objectives of the study and establishing the boundaries	28
5.2 Appointing a team leader and selecting the team	30
5.3 Preparation	34

6 Carrying out a study	40
6.1 Planning the meetings	40
6.2 The study meetings	41
6.3 Co-ordinating and reviewing responses	42
6.4 Completing and signing off the report(s)	43
6.5 Follow-up of actions and management of change	43
7 Recording	45
7.1 Background information	46
7.2 Section headings	46
7.3 The recording format for the detailed examination	46
7.4 The level of recording	47
7.5 The content	48
7.6 Computer recording	49
8 Training	51
8.1 Team members	51
8.2 Scribe	51
8.3 Team leader	51
9 Company procedures for HAZOP study	53
10 HAZOP study of computer-controlled processes	55
10.1 Hazard Study 2	56
10.2 Functional safety and IEC 61508	57
10.3 Enhanced HAZOP for computer-controlled systems	58
10.4 Computer HAZOP (CHAZOP) study	60
11 Specific applications of HAZOP	63
11.1 Modification of existing operations	63
11.2 Repeat designs – HAZOP-by-difference	64
11.3 Periodic hazard studies and the HAZOP of an existing plant	64
11.4 Operating procedures	65
11.5 Pilot plant and laboratory operations	66
11.6 Drains, vents and other interconnections between plants	68
11.7 Commissioning and decommissioning	70
11.8 Construction and demolition	71
11.9 Contract operations	72

12 Factors for a successful HAZOP study	74
12.1 Throughout the study	74
12.2 Before the study	74
12.3 During the study	75
12.4 After the study	76
Appendix 1 – The guideword-first approach to HAZOP	77
Appendix 2 – The use of checklists within HAZOP study	80
Appendix 3 – An illustration of HAZOP study for a continuous operation	82
A3.1 Methanol injection	84
A3.2 General process data	84
A3.3 The issues	85
A3.4 Methodology	86
Appendix 4 – An illustration of HAZOP study for a batch operation	109
A4.1 Introduction	109
A4.2 The company, site, plant and process	109
A4.3 The process stages selected for HAZOP study	110
A4.4 HAZOP study of steps 9 and 10, the reaction stage and workout	111
A4.5 A section of the HAZOP study report for the batch reaction	115
References and bibliography	132
Acronyms and abbreviations	134
Index	136