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THE EVALUATION OF HEALTH AND SAFETY
AUDITING SYSTEMS

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Doctor of Philosophy

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The University of Aston in Birmingham

The Evaluation of Health and Safety Auditing Systems

Jane Elizabeth Collison

Doctor of Philosophy 1995

Summary

The specific objective of the research was to evaluate proprietary audit systems. Proprietary audit systems comprise question sets containing approximately 500 questions dealing with selected aspects of health and safety management. Each question is allotted a number of points and an organisation seeks to judge its health and safety performance by the overall score achieved in the audit.

Initially it was considered that the evaluation method might involve comparing the proprietary audit scores with other methods of measuring safety performance. However, what appeared to be missing in the first instance was information that organisations could use to compare and contrast question set content against their own needs.

A technique was developed using the computer database FileMaker Pro. This enables questions in an audit to be sorted into categories using a process of searching for key words. Questions that are not categorised by word searching can be identified and sorted manually. The process can be completed in 2-3 hours which is considerably faster than manual categorisation of questions which typically takes about 10 days.

The technique was used to compare and contrast three proprietary audits: ISRS, CHASE and QSA. Differences and similarities between these audits were successfully identified. It was concluded that in general proprietary audits need to focus to a greater extent on identifying strengths and weaknesses in occupational health and safety management systems. To do this requires the inclusion of more probing questions which consider whether risk control measures are likely to be successful.

Key Words: health and safety, health and safety management, health and safety auditing, health and safety monitoring, health and safety performance.

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CONTENTS

CHAPTER 1

Research Aims	16
1.1 Introduction	16
1.2 Research aims	16
1.3 Structure of thesis	17

CHAPTER 2

The Development of Health and Safety Management.....	19
2.1 Robens Report.....	19
2.2 The adoption of self-regulation by industry.....	20
2.3 Encouragement by the Health and Safety Executive.....	20
2.4 Enforcement of health and safety legislation.....	21
2.5 Structured safety systems.....	22
2.6 Support for HSE's management model	26
2.7 Regulations on health and safety management.....	28
2.8 Future developments.....	28

CHAPTER 3

Auditing.....	30
3.1 Introduction	30
3.2 Systematic approach	31
3.3 Accident Inquiries.....	31
3.4 Company annual reports.....	32
3.5 Auditing as a legal requirement	33
3.6 Auditing and measuring performance	34

CONTENTS

3.7	Terminology used in this research.....	40
-----	--	----

CHAPTER 4

Proprietary Health and Safety Audits.....	42
4.1 Introduction	42
4.2 International Safety Rating System.....	43
4.3 The Complete Health and Safety Evaluation	46
4.4 Quality Safety Audit	50
4.5 Safety and Health Audit Reporting Package	51
4.6 Coursafe.....	52
4.7 The British Safety Council Management Audit System	53
4.8 Other proprietary audits	54
4.9 Approval of auditing systems	54

CHAPTER 5

Elements of a Successful Audit.....	56
5.1 Objectives of an audit.....	56
5.2 Elements of an audit.....	56
5.3 Scope	57
5.4 Auditors	58
5.5 Training.....	60
5.6 Scoring system	61
5.7 Question design.....	62
5.8 Managing the audit.....	64
5.9 The use of incident data.....	64
5.10 Results	65
5.11 Features of a successful audit.....	65

CONTENTS

CHAPTER 6

Evaluating Audit Systems.....	67
6.1 The use of accident statistics	67
6.2 Alternative methods of monitoring safety performance.....	67
6.3 Accident cause analysis.....	69
6.4 Previous work on proprietary audits.....	71
6.5 Methodology for this research.....	73

CHAPTER 7

Print-based Categorisation.....	75
7.1 Introduction	75
7.2 Categorisation by content	75
7.3 Derivation of the categories.....	75
7.4 Results of the content categorisation.....	78
7.5 Sorting into main headings.....	80
7.6 Conclusion.....	83

CHAPTER 8

Artificial Intelligence and Word Profiling	84
8.1 Introduction	84
8.2 Artificial intelligence.....	84
8.3 Word profiling.....	86
8.4 Assessment of the word profiles.....	86
8.5 Allocation of key words to a topic category	87
8.6 Topic weighting by word profiling.....	91
8.7 Comparison of word profile with print-based categorisation	91
8.8 Results of comparison.....	92

CONTENTS

8.9	Word profiles on selected parts of the audits.....	94
8.10	Group word profiling results.....	96
8.11	Word profiling as a categorisation technique.....	97

CHAPTER 9

Workplace Assessment.....	98
9.1 Objective.....	98
9.2 Methodology	98
9.3 Completion of CHASE.....	100
9.4 Completion of ISRS.....	102
9.5 Comparison of ISRS and CHASE	104
9.6 Conclusions from the trial.....	105

CHAPTER 10

Multi-tagging.....	107
10.1 Introduction	107
10.2 Assessment criteria.....	108
10.3 Categorisation using models of OH&S management.....	108
10.4 Categorisation by NVQ function	109
10.5 Development of a category list.....	111
10.6 Use of the coding system	113
10.7 Change to use of a database.....	113
10.8 Control outcomes and prescription categorisation.....	114
10.9 Results of the activity and prescription categorisation.....	115
10.10 Control outcome questions.....	118
10.11 Audit model.....	119
10.12 Conclusion.....	120

CONTENTS

CHAPTER 11

Database Development.....	122
11.1 Introduction	122
11.2 The database	123
11.3 Adaptation of category list.....	123
11.4 Question character	123
11.5 Health and safety organisational functions.....	126
11.6 People.....	128
11.7 Workplace.....	129
11.8 Work activities	130
11.9 Hazard identification and risk assessment.....	131
11.10 Risk control	132
11.11 Specific topics	133
11.12 Setting up the database.....	135
11.13 Importing questions into the database	139
11.14 Using the database.....	139
11.15 Conclusion.....	141

CHAPTER 12

Database categorisation results.....	143
12.1 Results	143
12.2 Comparison of the audits.....	143
12.3 Prescription.....	148
12.4 Probing.....	148
12.5 Health and safety organisation and functions.....	149
12.6 People.....	149
12.7 Workplace.....	151
12.8 Work activities	152

CONTENTS

12.9	Hazard identification.....	153
12.10	Risk control	153
12.11	Specific topics	154
12.12	Content in general	154
12.13	Comparison of ISRS with CHASE.....	158
12.14	Conclusions.....	162

CHAPTER 13

Review of Results	163
13.1 Introduction	163
13.2 The print-based categorisation	163
13.3 Word profiling.....	164
13.4 Workplace study.....	164
13.5 Multi-tagging of questions	165
13.6 Control outcome and prescription categorisation	166
13.7 Audit model.....	167
13.8 The database categorisation.....	168
13.9 Comparison of ISRS, CHASE and ISRS	169
13.10 Accuracy of the method.....	169
13.11 General approach to auditing.....	170
13.12 Audits modelled on OH&S management systems.....	170
13.13 Outcome data.....	171
13.14 Professional judgement.....	171
13.15 Emphasis on engineering control activity compared with health and safety organisation.....	172
13.16 Performance standards.....	172
13.17 Terminology.....	173
13.18 Future proprietary audits.....	173

CONTENTS

13.19	Use of the database.....	174
-------	--------------------------	-----

CHAPTER 14

Conclusions and Further Work	175
---	------------

14.1	Categorisation technique.....	175
14.2	Application of the technique.....	175
14.3	Fields outside health and safety.....	176
14.4	Evaluation of three proprietary audits.....	176
14.5	Proprietary audits are reactive rather than pro-active.....	177
14.6	Measuring successful OH&S management.....	177
14.7	Future proprietary audits	177
14.8	Further work.....	178

REFERENCES	180
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TABLES

CHAPTER 3

Auditing.....	30
3.1 Measuring performance and auditing (HSE 1991).	35
3.2 Measuring performance and auditing (BSI 1995).....	39
3.3 Monitoring and auditing (Tweeddale 1993)	40

CHAPTER 5

Elements of a Successful Audit.....	56
5.1 Features of a successful audit.....	66

CHAPTER 6

Evaluating Audit Systems.....	67
6.1 Systematic accident cause analysis (Waldram 1988).....	70

CHAPTER 7

Print-based Categorisation.....	75
7.1 Experimental format for categorising audit questions.....	76
7.2 Categorisation of the audit questions	77
7.3 Differences and similarities between ISRS and CHASE.....	79
7.4 Break-down of the questions into five areas of safety activity	81

CHAPTER 8

Artificial Intelligence and Word Profiling	84
8.1 Testing a hypothesis with an expert system shell.....	85

TABLES

8.2	Print-based categories.....	88
8.3	Key words and their frequency for ISRS and CHASE.....	89
8.4	Categorisation of the audits by word Count.....	90
8.5	Ranking groups	92
8.6	Rankings by different methods of categorisation.....	93
8.7	Keywords in a topic group compared with the complete profile for all questions	94
8.8	Group profiles compared with complete audit profile.....	95
8.9	Keywords for the 'incident reporting and investigation group.....	96

CHAPTER 9

Workplace Assessment	98
9.1 Information for completing the audits	99
9.2 Comparison of ISRS results with CHASE	104

CHAPTER 10

Multi-tagging.....	107
10.1 Function categories for OHASPs (NVQ 1993)	110
10.2 List of multi-tagging questions (Booth 1993b)	111
10.3 Prescription and activity outcomes for CHASE.....	115
10.4 Prescription and activity outcomes for ISRS.....	115
10.5 CHASE Documentation.....	116
10.6 ISRS Documentation.....	117

CHAPTER 11

Database Development	122
11.1 Prescription categories and key words.....	125
11.2 Probing index and key words.....	126

TABLES

11.3	Health and safety organisation and functions.....	127
11.4	People.....	128
11.5	Workplace.....	129
11.6	Work activities	130
11.7	Hazard identification and risk assessment.....	131
11.8	Risk control	133
11.9	Specific topics	134

CHAPTER 12

Database Results	143
12.1 Content comparison of 3 proprietary audits	144
12.2 Content comparison of 3 proprietary audits by number of questions.....	146
12.3 Analysis of management questions.....	150
12.4 ISRS, CHASE and QSA sorted by topic	155
12.5 Similarities between the audits.....	156
12.6 Differences between the audits.....	157
12.7 ISRS compared with CHASE.....	159
12.8 ISRS compared with QSA	160
12.9 CHASE compared with QSA	161

FIGURES

CHAPTER 2

The Development of Health and Safety Management.....19

2.1 Elements of OH&S management (HSE 1991).....23

CHAPTER 3

Auditing.....30

3.2 Audit and outcome data (Booth 1993).....36

CHAPTER 7

Print-based Categorisation.....75

7.1 Proportion of ISRS devoted to the 5 main topics.....82

7.2 Proportion of CHASE devoted to the 5 main topics.....82

CHAPTER 10

Multi-tagging.....107

10.1 Audit Model.....120

CHAPTER 11

Database Development122

11.1 A database layout.....135

11.2 Example of Question Evaluation.....137

APPENDICES

- 1 Word Profile ISRS
2. Word Profile CHASE
3. Database Field Definitions
4. Demonstration Disks - CHASE Evaluation
5. Database Categorisation QSA
6. Database Categorisation CHASE
7. Database Categorisation ISRS

CHAPTER 1

Research Aims

1.1 Introduction

In the 1980s few organisations audited their health and safety arrangements using formal audit systems. Organisations generally collected accident data only. The work of health and safety professionals was often unfocused and reactive. The introduction of proprietary audit systems¹ presented an opportunity to change this by providing information and impetus for pro-active safety management. However, first impressions of proprietary audits were that they were generally too onerous and many of the questions were either difficult to understand or ambiguous. They boasted that they were very thorough and suitable for all organisations but was this true? It was difficult to ascertain from their publicity and introductory chapters exactly what a proprietary audit included and their relative strengths and weaknesses.

1.2 Research aims

The specific objective of the research was to evaluate proprietary audit systems. Initially it was considered that this might involve comparing the proprietary audit scores with other methods of measuring safety

¹Proprietary audit systems comprise question sets containing approximately 500 questions dealing with selected aspects of health and safety management. Each question is allotted a number of points and an organisation seeks to judge its health and safety performance by the overall score achieved in the audit.

performance. However, what appeared to be missing in the first instance was information that organisations could use to compare and contrast question set content against their own needs. This research therefore sought to design and develop a method for analysing the style and content of proprietary audit question sets. A key requirement of the method was that it was objective and that the analysis could be carried out rapidly for instance, in about 2-3 hours. Thus the aim was to develop a computer-aided method. Detailed content analysis by other methods might typically take 10 days.

1.3 Structure of thesis

The thesis chapters are as follows:

1. Research Aims
2. Development of Health and Safety Management
3. Auditing
4. Proprietary Health and Safety Audits
5. Elements of a Successful Audit
6. Evaluating Audit Systems
7. Print Based Categorisation
8. Artificial Intelligence and Word Profiling
9. Workplace Assessment
10. Multi-tagging
11. Database Development
12. Database Results
13. Discussion
14. Conclusions and Further work

Chapter 2 offers an account of health and safety management as it has developed in the United Kingdom. Chapter 3 covers the role of

auditing within structured health and safety systems. An account of the background to, and content of, available proprietary audits is given in Chapter 4. Three of the audits described, namely the International Safety Rating Scheme (ISRS), the Complete Health and Safety Evaluation (CHASE) and the Quality Safety Audit (QSA) were analysed in detail. Chapter 5 considers elements of a successful audit and Chapter 6 how audits can be evaluated . Chapters 7 to 12 cover the research work that was carried out over a period of six years to categorise and evaluate proprietary audit question sets. Results are discussed in Chapter 13 and, conclusions and recommendations for further work in Chapter 14.

CHAPTER 2

The Development of Health and Safety Management

2.1 Robens Report

Since the publication of the Robens Report² in 1972 (Department of Employment, 1972) it has been recognised that health and safety must be managed pro-actively. Organisations can no longer expect government inspectors to tell them what to do or to be provided with prescriptive legislation which details all requirements for all industries. As Robens said:

"the primary responsibility for doing something about the present levels of occupational accidents and disease lies with those who create the risks and those who work with them".

This has led to the birth of what is termed 'self-regulation'. Essentially organisations should develop an OH&S management system in order to achieve self-regulation in their workplaces.

The committee envisaged that self-regulation required in particular:

- (i) the acceptance and exercise of appropriate responsibilities at all levels;
- (ii) better systems of safety organisation;
- (iii) more management initiatives;

²A committee of inquiry chaired by Lord Robens was appointed in 1970 by the Secretary of State for Employment and Productivity to review the provision made for the safety and health of persons in the course of their employment and to consider whether any changes were needed in the scope or nature of legislation and the nature and extent of voluntary action concerned with these matters.

(iv) more involvement of workpeople themselves.

To progress towards self-regulation they identified three pre-requisites:

- (i) awareness of the importance of the subject of safety and health at work;
- (ii) responsibilities, legal and otherwise clearly defined;
- (iii) the nature of the problems must be methodically assessed, and the assessments translated into practical objectives and courses of action.

2.2 The adoption of self-regulation by industry

Industry was slow to adopt the principles of self-regulation. It did not adopt safety management techniques because the legislation that followed the Robens' report did not require them to do so explicitly. There is a duty in the Health and Safety at Work etc. Act 1974 (Great Britain, 1974) for employers to have a written health safety policy as advocated by Robens. This requires a statement of intent, responsibilities to be defined and arrangements for health and safety. The Health and Safety at Work etc. Act 1974 (HSW Act) laid out the broad form workforce involvement might take but was silent on management organisation (Dawson 1988)

2.3 Encouragement by the Health and Safety Executive

The Health and Safety Executive (HSE) sought to promote the concept of OH&S management. In 1981 they published "Managing Safety" (HSE, 1981) an occasional paper prepared by their Accident Prevention

Advisory Unit (APAU). It emphasised the importance of managers taking responsibility for health and safety and the need to set objectives, organise and measure health and safety performance.

2.4 Enforcement of health and safety legislation

In 1985 the Health and Safety Commission (HSC) (1985) proposed a new approach to HSE enforcement based on work carried out with APAU. They envisaged that the HSE could formalise arrangements under which many more firms could satisfy them in a general way as to their safety policies and conduct, without the need for continuous intervention. For organisations to participate in this scheme they suggested that the following would be necessary:

- they must have a comprehensive health and safety policy;
- organisational arrangements must be acceptable and the management must be competent;
- appropriate resources must be available for health and safety;
- they must have securely established specialist health and safety expertise in-house;
- they must have active trade union involvement in safety and health with positive employee commitment;
- they must have a satisfactory recent record in relation to accidents and ill-health;
- arrangements must be fully acceptable both to the employer and the employee representatives concerned.

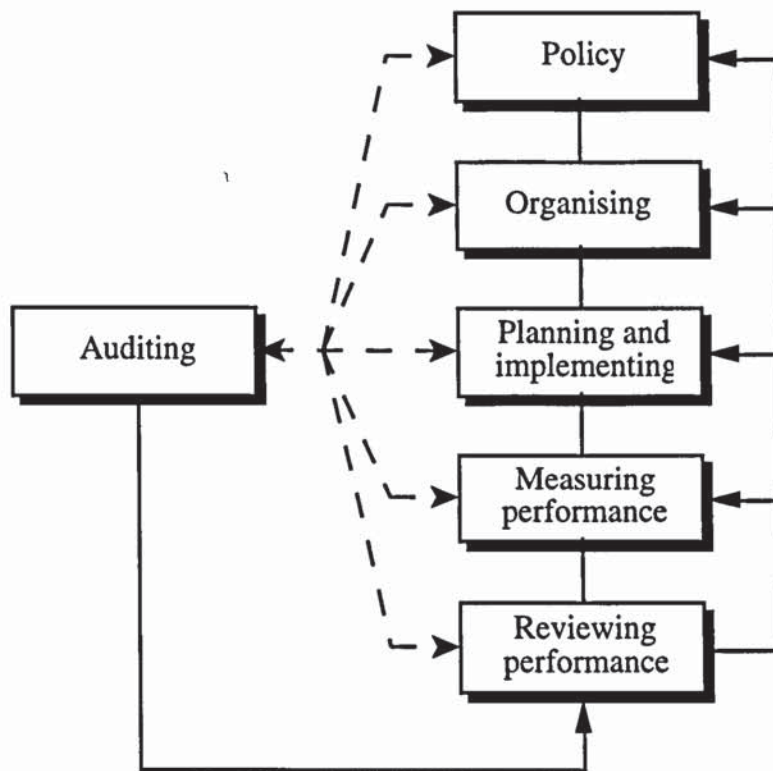
This scheme was seen by some, Church (1986) as self-enforcement rather than a practical development of the self-regulation. The Commission (1989) later admitted that its scheme for 'safety assurance' was not widely attractive to employers and was strongly opposed by trade unions. They therefore switched their attention to supporting the development of structured safety systems.

2.5 Structured safety systems

The first safety system model proposed in the UK was by HSE (1991) in guidance note HS(G)65 on 'Successful Health and Safety Management'. The guide was prepared by APAU and involves the application of the principle of total quality management³ (TQM) to health and safety, the prevention of accidents before injuries occur. OH&S Management was described in terms of five elements: policy, organising, planning and implementing, measuring performance and reviewing performance. Each stage is linked to auditing to show that it is necessary to check that objectives have been achieved. The elements of successful health and safety management as categorised in HS(G) 65 are shown in Figure 2.1.

³ Often referred to as quality assurance was founded by Juran (1975) who considered that careful measurement and analysis could reveal defects before a product was completed

Figure 2.1 Elements of OH&S management (HSE 1991)



Policy

HSE (1991) states that:

"Effective health and safety management demands comprehensive health and safety policies which fulfil the spirit and the letter of the law, which are effectively implemented and which are considered in all business practice and decision making."

Policies should recognise:

- that health and safety can contribute to business performance and that there is a connection with quality assurance;
- that there must be a systematic approach to risk assessment and control and that risk control should be understood;

- that leaders must develop an organisational structure and culture⁴ that supports risk control and the full participation of all members of the organisation;
- the need to plan and provide resources for implementation of risk control;
- that the organisation must be responsive to internal and external change;
- the need to scrutinise and review performance so as to learn from experience.

Organising

Organisations should secure control, encourage co-operation, effective communication and competence (HSE 1991). Control can be achieved by:

- managers leading by example;
- allocating clear responsibilities for policy formulation, development, planning, implementation of plans, reporting on performance and reviewing health and safety activities;
- allocating health and safety responsibilities to line managers with specialists acting as advisers;
- ensuring that those responsible have the necessary authority, competence and resources;
- ensuring that individuals are held accountable for their health and safety responsibilities and are motivated by target setting and positive reinforcement;

⁴"the safety culture of an organisation is the product of the individual and group values, attitudes, perceptions, competencies, and patterns of behaviour that determine the commitment to, and the style and proficiency of, an organisation's health and safety management." (HSC 1993)

- providing adequate supervision, instruction and guidance;
- ensuring that payment and reward systems do not cause conflict between output targets and health and safety requirements.

Co-operation of employees and safety representatives can be encouraged by informal and formal arrangements to involve them in policy development, planning, and implementation, measuring, auditing and reviewing performance. Effective communication can be achieved by visible behaviour, written material and face-to-face discussions. Competence through recruitment, selection, placement, transfer and training and the provision of adequate specialist device.

Planning

Organisations should draw up plans and set performance standards (HSE 1991). They should establish priorities for the provision and maintenance of control measures by carrying out risk assessment. Objectives should be identified and targets set for their achievement within a specific period. Performance standards should:

- be based on hazard identification and risk assessment;
- take legal requirements as the minimum standard;
- consider elimination of risks by substitution of safer premises, plant or substances in preference to risk control. If this is not reasonably practicable engineering controls should be adopted in preference to safe systems of work or personal protective equipment. Temporary control measures should be adopted where satisfactory control cannot be achieved immediately;
- consider risks to employees and non-employees;

- be documented, the detail of the documentation reflecting the degree of risk.

Measuring Performance

Organisations should undertake active monitoring and reactive monitoring (HSE 1991). Active monitoring should measure the achievement of objectives and specified standards. High risk areas should be monitored in more depth and/or more frequently. Reactive monitoring is the collection and analysis of accident data (injuries and ill-health, damage to property, near-misses) and weaknesses or omissions in performance standards. Monitoring information should be evaluated by persons competent to identify a risk to health and safety. Both immediate and underlying causes of events should be considered and referred to the level of management with authority to initiate the necessary remedial action.

Auditing and reviewing performance

Learning from experience through the use of audits and performance review enables organisations to maintain and develop their ability to manage risks to the fullest possible extent (HSE 1991). Auditing is considered in more detail in Chapter 3.

2.6 Support for HSE's management model

Following 'Successful health and safety management' (HSE 1991) other organisations have proposed similar models of OH&S Management. These organisations include the Advisory Committee on Safety in

These organisations include the Advisory Committee on Safety in Nuclear Installations (ACSNI) Human Factors Study Group (HSC 1993) and the British Standards Institution in the draft British Standard Guide to OH&S Management System.

ACSNI in its third report on organising for safety (HSC 1993) proposed the inclusion of the following elements:

- Policy and planning
- Organisation and communication
- Hazard management
- Monitoring and review of safety performance

Differences from HS(G)65 are that planning is linked to policy, organisation includes communication, hazard management is included explicitly whereas in HS(G)65 it is part of 'planning and implementing' and the term monitoring is used instead of measuring performance. Auditing is not included in HSC (1993)

The British Standards Institution (BSI 1995) in its draft guide to OH&S Management Systems proposes the following elements of a successful health and safety management system:

- initial and periodic status review
- policy and objectives
- organising
- planning and implementing
- measuring performance

HSE (1991) because the authors decided after study to follow the framework of this document. The guide is a draft, a decision has yet to be made as to whether it will be adopted as a British Standard.

2.7 Regulations on health and safety management

In 1992, as members of the European Union (EU), the United Kingdom were required to implement a framework directive on health and safety. To satisfy this requirement the Management of Health and Safety at Work Regulations 1992 (MHSWR) (Great Britain, 1992) were introduced in the UK. These regulations required employers to carry out risk assessments in order to decide priorities and set objectives for hazard elimination and risk reduction. They gave further impetus to the concept that it is necessary to manage health and safety and that strategies should be based upon pro-active risk assessment.

2.8 Future developments

HSC (1994) has concluded its review of health and safety legislation started in 1992 and will seek to implement the findings. The review was undertaken by a number of industry task groups who looked at the legislation which applied to their particularly industry. In general there appears now to be a desire to return to the architecture of health and safety legislation proposed by Robens. Some European directives have required too much prescriptive legislation and there is a need to return to goal setting regulations based upon sound cost-benefit and risk assessment. It is suggested that voluntary improvement should be encouraged by use of health and safety management specifications,

guidelines and accreditation bodies such as ISO 9001 (HSC 1994).
Although excessive bureaucracy should be avoided.

CHAPTER 3

Auditing

3.1 Introduction

Traditionally health and safety performance was measured only by accident data. According to Booth (1993) accident data as a performance indicator:

- measures failure, not success
- exhibits random fluctuations (there may not be enough accidents to establish statistically significant trends)
- involves a time delay before the effectiveness of control measures can be established
- does not measure chronic affects
- measures the number of injuries, not the number of accidents
- may be affected by the time different people spend off work for a given severity of injury
- are difficult to compare across sites, and with published data
- may be misleading because some accidents may not be reported, and there may be hidden differences in reporting criteria
- provide evidence only of what has already gone wrong. They may be poor predictors of future performance
- are particular limited as a performance measure in major hazard industries where accidents may be rare, but the potential consequences disastrous

- do not assess the timeliness, or the cost-effectiveness, of health and safety effort

Auditing may not overcome all these problems but is a more proactive method of assessing health and safety performance and can measure success as well as failure.

3.2 Systematic approach

Since the early days of Robens, auditing has been seen as a key element of health and safety management. Robens said that there is a need to assess methodically problems and that in the opinion of the committee too few firms made use of diagnostic and predictive techniques such as safety sampling or hazard analysis, or safety audits. They concluded that employers should adopt a more scientific and systematic approach to accident prevention rather than rely on *ad hoc* patching up of deficiencies which injury accidents bring to light. In HSE (1981) the absence of measurement of health and safety performance was given as the main reason why commitment to health and safety expressed by top management in organisations surveyed was not actively pursued.

3.3 Accident Inquiries

Recent accident inquiries have commented on the importance of monitoring safety and suggested that auditing is carried out. The following are extracts from the investigation into the King's Cross Underground Fire (Department of Transport, 1988) and the Piper Alpha Disaster (Department of Energy, 1990).

"London Regional Transport should be directed to develop a system of safety reporting which would satisfy their Board that London Underground has in place satisfactory measures to ensure safety of operation. Such reporting should include an independent assessment of hazard from fire, congestion and other aspects that London Regional Transport identifies. Quantifiable objectives should be set whenever possible."

"If the internal audit has become the yardstick by which financial performance is measured then the safety audit should become the yardstick by which safety is measured. Only with such a management tool can the Board, and hence the general public be satisfied that aspects of safety are maintained at the right level."

"Common sense and experience of what happened on Piper indicate that it is not enough to set up a systematic approach to safety and put it into operation. There is a plain need to review and up-date the system in the light of experience both of the operator and of the industry. It is also necessary to "audit" the extent and quality of adherence to the system and to "verify" that its results are in practice satisfactory.(p.358)"

3.4 Company annual reports

Section 79 of the HSW Act allowed regulations to be made to require companies to publish health and safety performance data in their annual reports (Dawson, 1988). These regulations were not made and although including such information is regarded as best practice (Whitmore, 1995) it is not always done. The following is an extract from the annual report of Courtaulds (1995).

"The improved level of safety performance reached in 1993/94 was maintained through the past year, and some further progress was made. Fundamental to such progress is detailed attention to investigating the causes of accidents and the training of all managers to observe and prevent the unsafe acts which underlie the majority of them. These safety auditing techniques were introduced to Courtaulds two years ago by the DuPont programme, which was completed during 1994/95. The training of all managers in safety to National Examination Board in Occupational Safety and Health (NEBOSH) Certificate standard continued. Particular emphasis has been placed on the needs of managers in the Asia-Pacific businesses, where rapid development has entailed the induction of many new employees. At the same time, the health, safety and environment support provided for these businesses has been strengthened significantly. Across the Company as a whole, the programme of upgrading process safety standards to best international practice continued with the introduction of a series of new engineering codes of practice "

This statement is far more detailed than most that appear in annual reports. Reference to safety performance and inclusion of accident data and audit data in annual reports may become more common in the future.

3.5 Auditing as a legal requirement

In the past auditing has been seen as good practice and its uptake has been voluntary. It has been recommended by Robens, HSE and by accident inquiries. Since 1993 monitoring of preventive and protective measures has become an explicit legal requirement. Regulation 4 of the Management of Health and Safety at Work Regulations 1992 (MHSWR) (Great Britain, 1992) states:

"Every employer shall make and give effect to such arrangements as are appropriate, having regard to the nature of his activities and the size of his undertaking, for the effective planning, organisation, control, monitoring and review of the preventive and protective measures."

Auditing is arguably an implicit legal requirement because appropriate arrangements for review should require audit as well as monitoring data.

3.6 Auditing and measuring performance

In HSE (1991) auditing is described as an examination of all safety management elements as they apply to one particular topic or an examination of one safety management element in depth. This should be done periodically by an independent person such as an external consultant or by staff from other departments or sites from the one being audited. Measuring performance is considered to be something that is done in-house by management, supervisors, safety representatives etc. on a continual basis. These people should monitor injury accidents, ill-health, dangerous occurrences, achievement of objectives and compliance with standards. The distinction made between auditing and measuring performance is summarised in Table 3.1.

Table 3.1 Measuring performance and auditing (HSE 1991)

Measuring Performance

- active systems which monitor the achievement of objectives and the extent of compliance with standards
- reactive systems which monitor accidents, ill health, incidents and other evidence of deficient health and safety performance, such as hazard reports
- by management, supervisors, maintenance staff, safety representatives or a team

Auditing

- 'vertical slice' an examination of one specific aspect in each of the safety management elements e.g. policy etc. on eye protection
- 'horizontal slice' one particular element of the safety management system is examined in detail. e.g. an in-depth examination could be made of the whole process of planning.
- undertaken either as a single event or as a rolling programme with different aspects, sections or departments examined in turn.
- audits should be conducted by competent people independent of the area or activities being audited e.g. by using external consultants or by using staff from different sections, departments or sites to audit their colleagues
- organisations may use either their own self-developed auditing system or those marketed as proprietary systems or a combination of both
- qualitative and quantitative data

HSC (1993) state that employers should seek to monitor key performance indicators⁵ and audit compliance with safety procedures. They call key performance indicators '*Output*' data and measures of compliance '*Audit*' data. This is the same approach as described in Booth (1993) although the term '*Outcome*' data is used instead of '*Output*' data.

Figure 3.1 Audit and outcome data (Booth 1993)



⁵ indicators that lead (predict) outcomes such as injuries

'Outcome' data was also considered by Dawson et al (1982). They wrote that the prevention of accidents is such a negative aim, the objective of monitoring should be to control hazards. To control hazards an effective programme for health and safety at work must involve a management strategy which pays attention to the development of technical controls (hardware and software) and motivational controls (responsibility, accountability and commitment). They identified two basic reasons for monitoring which they considered paramount:

- to identify and seek to solve problems which occur in the course of attempting some aspect of the control processes;
- to provide information on the performance of individuals and /or groups with a view to motivating them to maintain their good performance or to remedy their poor performance.

They put what could be monitored into three categories:

- control activity
- control outcomes
- hazard outcomes.

Control activity includes technical control activities such as identification of hazards, assessment of risk, choice of control measure and implementation and motivational control activity, suitability of safety policy, defining responsibility and mechanism for fixing accountability. Control outcomes are the actual 'acts and conditions' which reflect the implementation of control measures. Hazard outcomes are injury accidents and ill-health, the result of a hazard being realised.

BSI (1995) states that an audit is a deeper and more critical appraisal than measuring performance on a routine basis. The differences are summarised in Table 3.2. An audit should assess the overall capability of a system, identify strengths and weaknesses, and verify that an organisation carries out and achieves what it claims to do. This it says can be done by addressing selected topics or by being fully comprehensive.

Tweeddale (1993) considers that an audit is a periodic check and monitoring/measuring a continuous process. He states that audit should not be a detailed examination of everything.

"An audit which attempts to cover everything is very time-consuming and dilutes line managers' responsibility for safety because the managers see the audit as replacing ongoing monitoring."

The distinction made between monitoring and auditing by Tweeddale is summarised in Table 3.3.

Table 3.2 Measuring performance and auditing (BSI 1995)

Measuring Performance

- the extent to which objectives are being met
- compliance with the organisation's health and safety arrangements
- reactive monitoring of accidents, ill-health, incidents and other historical evidence of deficient health and safety performance
- routine

Auditing

- capability of the organisation's overall OH & S system at achieving the required standards of OH&S performance
- fulfilment of the organisation's (or part of it) obligations with regard to OH&S
- strengths and weaknesses of the OH&S management system
- whether the organisation (or part of it) actually carries out and achieves what it claims to do
- periodic
- comprehensive or address selected topics according to circumstance
- conducted by persons who are, preferably, independent of the activity that is being audited, but may be drawn from within the organisation
- audit teams should be competent to audit the relevant managerial and technical issues

Table 3.3 Monitoring and Auditing (Tweeddale 1993)

Monitoring

- is a line management responsibility
- is the primary means of providing a high standard of health and safety
- covers all matters relevant to health and safety
- is undertaken continually

Auditing

- involves people from outside the line management structure
- is a 'protective system' to cope with defects in the primary safety management hardware and software
- covers the broad field superficially, and selected parts in detail
- is undertaken periodically

3.7 Terminology used in this research

There are differences in the terminology used in OH&S management systems models. HSC (1993) like the Management regulations use the term monitor whereas the British Standard follows HSE (1991) and uses the term measure to describe routine collection of data on for example accidents, compliance with standards and achievement of objectives. Audit is generally used to describe thorough checks that are carried out periodically by external (independent) people. In the British Standard it is also suggested that an audit is carried out initially to provide baseline data from which future performance can be measured and to assist in the planning process.

In this research it is recognised that it is important to monitor continuously health and safety performance and periodically to have the OH&S management system checked independently. However, it is not essential that the external assessment is called an audit and internal checks monitoring or measuring performance. It may be quite appropriate to conduct an internal compliance audit as part of a programme of continuous health and safety monitoring. The proprietary question sets will be referred to throughout the thesis as 'proprietary audit systems'. This is because they are normally used periodically and in general are more suited to an auditing function as described in HSE (1991).

CHAPTER 4

Proprietary Health and Safety Audits

4.1 Introduction

This research project was started in April 1988 at a time when a new proprietary auditing system had recently been brought on to the market. The audit: the Complete Health and Safety Evaluation (CHASE), was competition for the long-established American audit: the International Safety Rating System (ISRS). CHASE was designed and promoted by Health and Safety Technology and Management Limited (HASTAM) and ISRS by the Royal Society for the Prevention of Accidents (RoSPA) on behalf of the producers the International Loss Control Institute (ILCI). As the ISRS and CHASE manuals could be obtained at a relatively low cost without the condition that the purchaser attend an auditors accreditation course these audits were chosen as the proprietary audits for this research work. The only other audits known to be available at the time were Technica's MANAGER originally produced in 1986 (Pitblado et al, 1990) and The British Safety Council's 'Management Audit System with Star Grading'. The latter audit question set was only available to British Safety Council accredited auditors. The Quality Safety Audit (QSA), first published in 1992, was used for later work. Many other audit manuals and computer demonstration disks were obtained and studied during the research period.

4.2 International Safety Rating System

The International Safety Rating System (ISRS) was developed by the International Loss Control Institute (ILCI) based in Loganville, Georgia, USA (Bird 1988), the first edition was published in 1978 (ILCI 1986). It was originally distributed in the UK for ILCI by RoSPA. In the 1990s ILCI was taken over by Det Norske Veritas (DNV). DNV Management Services are now the UK distributors for the 6th edition of ISRS.

The International Loss Control Institute was founded by Frank E Bird Jr (Arnold 1993). Bird pioneered the loss control approach to safety that places emphasis on all accidents, not just those resulting from injury. Whilst Bird was employed by an Insurance Company he worked on a system to profile or measure an organisation's total loss activities. His 'Total Loss Control Profile' was registered with the United States Patent Office in the late 1960s (Arnold 1988). ISRS evolved from this original patent and work carried on safety programmes with Robert G Loftus, Executive Vice President of the Industrial Accident Prevention Association of Ontario (Bird and Loftus 1976).

ISRS consists of questions arranged in chapters called programme elements (ILCI 1986). The 20 programme elements are:

- Leadership and Administration
- Management and Training
- Planned Inspections
- Job/Task Analysis and Procedures
- Accident/Incident Investigation

- Job/Task Observations
- Organisational Rules
- Emergency Preparedness
- Accident/Incident Analysis
- Employee Training
- Personal Protective Equipment
- Health Control and Services
- Program Evaluation System
- Purchasing and Engineering Controls
- Personal Communications
- Group Meetings
- General Promotion
- Hiring and Placement
- Records and Reports
- Off-the-Job Safety

The questions in each element are given a star rating from one to five, in two categories: standard and advanced. The points awarded for each element are allocated according to information gathered from opinion polls of Accredited Safety Auditors who were actively using ISRS (ILCI, 1986).

ILCI suggest that ISRS can be used by qualified corporate-level personnel, by qualified personnel at the unit level and/or by qualified external auditors. The auditor or auditing team should measure the degree of compliance with the audit criteria using actual count, random sampling, and professional judgement techniques. Information from which the auditor(s) will base their conclusions

should be derived from interviews with knowledgeable persons, record and documentation checks, verification interviews with all levels of site personnel, and a physical conditions verification tour. Once the audit's measurements have been made, results should be recorded and scores derived. The audit scores determine the level of recognition achieved.

ISRS is claimed to be a tool to manage the control of all accidental loss, injuries, illnesses, property damage, fires, and explosions. ILCI suggest that the system will :

- provide a precise evaluation of safety performance;
- provide a means for appraising individual and group performance;
- provide a guide for implementation of a modern programme;
- provide a practical, ongoing means for identifying the majority of hazards;
- provide a strong indicator to employees that management cares about them;
- provide knock on improvements to a total quality programme;
- provide general communication knowledge and skills;
- provide a means for stimulating a healthy, competitive atmosphere;
- provide a capability to forecast the potential for loss-producing events;
- reduce costs of accidents and other losses by eliminating inefficiencies;
- provide companies with an equitable means of comparison
- stimulate increased pride of performance;

- create a new zeal for improvements in safety;
- provide a practical tool for an organisation of any size to measure and evaluate its safety;
- earn recognition esteemed around the world;

In the ISRS manual it was reported that companies belonging to the Rural Electric group in the United States who used ISRS had over 50% fewer accidents than the average member company.

4.3 The Complete Health and Safety Evaluation

The Complete Health and Safety Evaluation (CHASE) products are sold by Health and Safety Technology and Management (HASTAM). HASTAM was formed in July 1984 by key Occupational Health and Safety staff of Aston University (HASTAM 1995). The company now based at Aston Science Park which is adjacent to the Aston University campus. HASTAM has been involved in the development of audit manuals and computer audits since the late 1980s when CHASE I and CHASE II were first published. Their products now include:

- CHASE II version 5.1
- CHASE III version 1
- CONSTRUCTION CHASE
- COSHH CHASE
- ENVIRONMENT CHASE
- CATCH

These audits are available as manuals or as computer software packages. CATCH is a computer package into which users can input their own questions, scores and guidance notes.

CHASE I, which was written for small companies and departments of larger firms was withdrawn in 1995 (Hewitt 1995). This research looked at CHASE II version 4.1. The later version 5.1, which is now available retains the same chapter headings although additional questions have been added relating to risk assessment and recent legislation such as the Management of Health and Safety at Work Regulations 1992. CHASE III was published in 1995 and is based on HSE(1991). It is a three tier audit incorporating a board audit, a group audit for middle management and an area audit for front line managers (Hewitt 1995).

CHASE II was written by a number of health and safety specialists who were invited to write questions for the audit by the development board which consisted of R T Booth, A J Boyle, A I Glendon, A R Hale and A E Waring.

CHASE II questions are divided into chapters representing various aspects of the management of health and safety. The Chapter titles for CHASE Version 4.1 are:

- Management of Legal Requirements and Resources
- Management of Tools, Equipment, Fixtures and Fittings
- Management of Machinery and Plant
- Management of Chemicals and Substances
- Management of Vehicles
- Management of Energy
- Management of Health
- Management of Tasks
- Management of People
- Monitoring and Feedback for Health and Safety
- Management of Change
- Management of Emergencies and Special Cases

There are no star ratings, all questions should be answered if appropriate and responses used to calculate the organisation's performance rating as a percentage of the maximum possible. When a series of questions is inappropriate they can be by passed and their scores deducted from the maximum attainable score so that overall percentages are not affected.

It is suggested that supplementary information should be recorded in the manual where necessary. For example when the questions use phrases: 'adequate arrangements', 'appropriate arrangements', 'frequent.....'. Adequate, appropriate and frequent relate to particular circumstances, adequate for an area of responsibility, appropriate for an existing hazard level and frequent in view of the particular risks involved. When answering questions like this, the actual

arrangements or time scales should be noted in the manual. Other questions take the form 'Are all employees...', '..all Regulations....'. If the appropriate answer is 'some but not all' it is suggested that the answer should be 'no' with the reason that a 'yes' answer is impossible noted in the manual.

It is intended to be usable by non-specialists such as directors or managers as well as safety advisers or by health and safety committees and training departments. It is designed for repeated use in the same organisation or department to plot progress.

The forward to the audit states that the aim of CHASE is to provide managers and others with quick and straightforward answers to the key questions:

- Are we doing enough for health and safety?
- Are we applying health and safety effort as effectively and efficiently as possible?
- Are we complying with the law ?
- Are we protecting all people affected by our activities?

It is claimed that the manual:

- highlights all the common sources of risk
- provides a simple but effective means of quantified monitoring of risk control effectiveness
- is a check on whether systems to identify new sources of risk are in operation.

4.4 Quality Safety Audit

The Quality Safety Audit (QSA) is marketed by RoSPA. It is available as a manual and as a computer package. It is based on the HSE (1991) publication 'Successful Health and Safety Management' and the audit sections are:

- Policy - policy general and policy commitments
- Organising - organising for health and safety and organisational procedures
- Planning for implementation of policy - the planning process, organisational procedures implementation and risk control performance indicators
- Measuring performance - active and reactive monitoring
- Audit and performance review

QSA is claimed to adopt the HSE principle of performance standards as its base (Deacon 1995). Performance standards are defined by Deacon (1995) as a means by which health and safety objectives can be achieved. They are divided into those for organisational performance and those for control of hazards and risks. The performance standard for control of hazards and risks was based on the HSE (1991) criteria of hazard identification, risk assessment, risk control, implementing and maintaining risk control measures.

The QSA development team constructed model performance standards for the most common hazards encountered within industry and commerce and turned them into a series of audit questions (Deacon,

1995). However, these hazards could not be found in the contents list of the audit, although the audit includes the following topics which presumably relate to the common hazards mentioned:

- Electricity at Work Regulations
- Manual Handling Regulations
- Display Screen Equipment
- Control of Substances Hazardous to Health (COSHH)
- Personal protective equipment
- Procedures for serious and imminent danger
- Procedure for danger areas
- Control of contractors and visitors

RoSPA administer an award scheme for QSA. It is for five levels of attainment. Level one requires an average score in each section of 30%, level two 45%, level three 60%, level four 70% and level five 80%. RoSPA also provide training for in-company auditors. To become a QSA auditor requires successful completion of an examination and an initial audit.

4.5 Safety and Health Audit Reporting Package

Safety and Health Audit Reporting Package (SHARP), a computer audit, was developed in 1990 by Safety and Reliability Consultants (SRC) of Warrington. The SHARP appraisal is performed on the software program Microsoft Excel, which requires responses from the auditor to over 800 prompts. Each prompt selected during the appraisal is provided with an optional weighting factor which may be adjusted

by the auditor to suit the circumstances. The question prompt can be marked by an auditor as a management function or an operational function. This is so that for example, an office cleaner is not asked about his contribution to preparation of the corporate health and safety policy and conversely the managing director is not asked about types of padlock hasps available in electrical isolation procedures (SRC 1992). The system has been configured to avoid forced-choice yes/no answers, by introducing intermediate answers of almost and not very. Questions which do not apply to a particular site can be omitted. When all the sections have been answered, the completed summary table may be used as a basis for recommendation of improvements. A two-dimensional approach to formulating recommendations is adopted; first, the allowable follow-up time for implementation is suggested and secondly, the degree of hazard severity of a possible incident resulting from failure to acknowledge the recommendation is highlighted.

The comment is made in the SRC publicity that one of the purposes of SHARP is to be detailed but not oppressive. The questions in SHARP are divided into three main groups:

- organisation and arrangements (25 sections)
- safety appraisal (32 sections)
- health appraisal (14 sections)

4.6 Coursafe

Coursafe which is a computer audit was developed initially by safety professionals at Courtaulds plc using HASTAM Software and launched

in 1990. In 1991, Edward Alandale Associates were appointed to market and develop the product (Edward Alandale Associates 1995). Coursafe is a shell which users customise to suit their specific needs by writing or purchasing sets of questions which are referred to as modules. A module can consist of up to 729 questions divided into 9 sections. Modules have been written on general safety, permit to work systems, environmental management and COSHH. The questions predominately require a yes/no or not applicable answer, but some questions require a percentage degree of compliance. A user group has been established, members of the group can use a help desk, automatically receive free upgrades, newsletters and invitations to user group conferences.

4.7 The British Safety Council Management Audit System

The British Safety Council (BSC) Safety System is a manual available to their accredited auditors. In the 1960's BSC started to develop an approach to accident prevention based on the technique 'management by objectives' (BSC 1993). The audit system includes 77 items arranged under five main headings:

- safety organisation
- machine guarding, electrical, and personal safeguarding
- fire protection and prevention
- accident recording and investigation
- premises and housekeeping

Rather than questions, the audit is made up of statements of requirements e.g.

"All hazardous moving machine parts within normal reach completely guarded/fenced"

To verify the statements it is emphasised that it is necessary to inspect the workplace and ask management and staff key questions. The final star rating given to a site is dependant on the score achieved in the audit and the disabling injury frequency rate.

4.8 Other proprietary audits

The number of proprietary audits available has increased rapidly since the start of this research when only three were known to be marketed in the UK. The majority of the new audits are DOS or Windows based computer audits with the facility to print out audit questions. Some of these new audits are listed:

- PROFILE a computer audit marketed by the University of Strathclyde (1994)
- SAFETY AUDITOR a computer audit by Ergosystems (1994)
- MERLIN by Occupational Safety Consultants and Research Ltd.
- PRISM by AEA Technology
- SALUS a computer audit used by the Amoco Oil Company (Simpson 1995)
- AUDIT a computer audit by Norton Waugh Computing Ltd.

4.9 Approval of auditing systems

HSE (1989) have said that they are encouraged by the emergence and use of safety monitoring packages but that they will not approve any

proprietary audits. Their policy in 1989 was as stated below and remains current:

" We will continue to encourage the concept of monitoring safety performance either by self developed schemes or by the use of proprietary schemes. No schemes will be officially approved by the Executive . It will be each undertaking to decide which scheme best meets its needs and to make its own choices on costs and potential benefits."

CHAPTER 5

Elements of a Successful Audit

5.1 Objectives of an audit

The objectives of an audit are to assess the overall capability of a OH & S system, identify strengths and weaknesses, and verify that an organisation carries out and achieves what it claims to do (BSI 1995). Audits must take into account differences within organisations. For an audit to be successful it must be compatible with the organisation, and its OH&S management system. However, organisations and their OH&S management systems have many common features that can be taken into account in a proprietary audit.

5.2 Elements of an audit

Elements of an audit from HSE (1985) 'Monitoring Safety' were used as a framework for identify criteria that might affect how good an audit was at achieving its objectives. As this research was concerned particularly with questionnaire style audits, an additional element called 'question style' was included. The audit elements used are as follows:

- scope
- the auditors (e.g. line managers, trade unions, safety specialists)
- training (e.g. additional training required or not, in-house/external)
- the audit (e.g. numerical or subjective or both)
- question style
- managing the audit (e.g. how long, how frequent)
- the use of incident data (e.g. should these be included)
- using the results (e.g. reporting procedure, action taken)

5.3 Scope

In the literature there are different opinions on whether an audit should be fully comprehensive or just look at certain areas of safety management in detail. Other disciplines appear more often to define the scope of an audit. In the field of environmental management it is common to label an audit according to its purpose. For example there are legislative compliance audits, due diligence⁶ audits and environmental performance audits.

The proprietary audits discussed in Chapter 4 in general took a comprehensive approach. They either examined each management element in depth for all hazards or assessed whether each element was applied to a number of named topics. To use the HSE (1991)

⁶ "Due diligence investigations are associated with merger or acquisition activities. Such investigations concern the assessment of significant environmental and other liabilities - past, present and future- associated with an installation for the purposes of corporate acquisition. These liabilities may be associated with contaminated land, existing or potential litigation, or the need to install new pollution technologies "(Environment Business 1991)

terminology they sometimes took a 'horizontal slice' and sometimes a 'vertical slice'. The three audits evaluated in detail took the following approach:

- CHASE could be described as a 'vertical audit' of specified topics such as machinery and plant.
- ISRS is more akin to a number of 'horizontal audits' or in depth studies of elements of safety management such as leadership and administration.
- QSA is a mixture of horizontal for each of the management elements and vertical for a few named topics such as manual handling.

A good audit should explain the approach that has been taken and specify which elements of the O&H management system or which hazards have been included.

5.4 Auditors

HSE (1991) states that effective audits tend to be carried out by competent people who are independent of the area or section being audited. This may involve one person, a team of managers, specialists and non-management employees or external consultants. In HSE (1985) it is stated that measuring systems require the active participation of those being measured. It is not made clear in HSE (1985) whether this is for continuous monitoring of health and safety performance or for all measuring including auditing. The proprietary audit CHASE is designed for use by line managers, thus it adopts the approach given in HSE (1985).

Organisations that have reported on their auditing arrangements tend to use internal auditors or a combination of internal audits and external audits. Kodak (James 1994) carry out audits using COURSAFE with a team of three or four people from one of the 23 work areas. They moved away from external auditors because of:

"the time elapse between visits; a tendency for audits to encourage defensive, compliance approach to the management of health, safety and environmental matters on the part of local managers; and a tendency for them to provide essential negative, and hence demotivating feedback to managers as a result of the emphasis on detailing weaknesses rather than appraising strengths."

British Waterways (James 1995) require engineering supervisors to carry out six-monthly audits within the units for which they are responsible. However, then considered it necessary to introduce some form of verification and the adequacy of the audits is now checked by audits conducted by the health and safety function (Bevan 1995).

Corn and Lees (1983) said that auditors should be highly regarded by site personnel and display depth of knowledge.

"There is a tendency to formalise audit procedures, to create lists of program ingredients and to have relatively inexperienced personnel check off items or assign numerical ratings to them. These procedures seriously dilute the intent and effectiveness of the audit program, which is designed not only to serve line management, but also to educate industrial hygiene program personnel. Proper auditing demands extensive discussion on site, a give and take between colleagues, i.e. auditor(s) and site personnel. This process requires that auditors be highly regarded by site personnel and that they display depth of knowledge in the subject, knowledge derived from broad program exposure and technical and managerial understanding. Proforma check list auditing appeals to the desire to classify and simplify, but while eventually possible, we are not at that stage of development in the art and science of industrial hygiene auditing."

The role of workforce representatives in health and safety auditing is unclear. HSE (1991) mention non-management employees as possible groups for inclusion in the audit team. Dawson et al (1982) found that the inclusion of shop floor personnel decreased line management participation and made the assessment aspect of the audit generally less acceptable. It is important that the Robens' philosophy of workforce involvement is carried forward into health and safety auditing.

In general the opinion appears to be that audits should be designed for competent trained persons who are independent of the area being audited, but that those people responsible for OH&S management should be involved as much as possible in the audit process.

5.5 Training

The majority of the proprietary audit producers arrange training courses and accredit persons to use their systems. A training course should not be provided to overcome shortcomings in the audit such as poorly written or ambiguous questions. A good audit should be 'user friendly' and should not require to be backed up by training to explain the questions. Training courses should be directed at teaching interview skills and other audit management techniques. The one week training course for ISRS covers the background to the audit such as Bird's total loss approach and then takes on a case study approach for teaching auditors how to answer the questions in different situations (Simpson 1995). It was reported that Engineering Supervisors attended a two day course to enable them to use the CHASE audit (James 1995).

5.6 Scoring system

The audits use a variety of different scoring methods including :

- all-or-nothing (yes/no);
- intermediate answers (no force yes/no answers, include almost/not very etc.);
- de-merit (zero for no hazard);
- merit (marks for good performance)
- percentage compliance.

With a scoring system poor performance in one area can be offset by good performance in another area. Proprietary audits often try to overcome this problem by weighting questions according to their importance. In this way failing to do something important cannot be completely offset by doing something relatively unimportant.

There is increasing pressure on audit systems to be quantifiable. This leads to judgements being made about success or failure that can create a number of problems. For example in Dawson et al (1982) it was reported that the quantitative element of an audit caused resentment from line management. In Eisner and Leger (1988) competition between mines over star ratings was considered in some cases to lead to falsification of records. At British Waterways (James 1995) they were concerned that audit results could generate damaging internal competition.

A good audit will have correctly weighted questions. Eisner and Leger (1988) questioned some of the weightings in the mine version of ISRS.

A good audit will have correctly weighted questions. Eisner and Leger (1988) questioned some of the weightings in the mine version of ISRS. For example 260 points were available for establishment of rules and procedures and only 40 points for rule compliance as observed by the field auditors. They made the following comment:

"Such scoring clearly favours the management whose 'paper situation' is unassailable, yet whose ability actually to persuade its workforce to comply with it is not being adequately tested."

Safety auditing should not become an end in itself but should be interpreted to give positive useful information to the company (HSE 1985).

5.7 Question design

Audit questions are either stand alone or have to be read in conjunction with other supporting text which is given in the audit. Some audits such as QSA favour the later approach. This can be inconvenient if it is necessary to constantly refer back to introductory paragraphs on another page in the audit. In the questions themselves a number of factors affect how easy they are to use.

Comprehensible

The questions must be written so that they can be understood by those who will use them. They must not contain jargon that is specific to certain industries, countries or professions and they must not be ambiguous.

Single

Two or three questions must not be included in one unless they are so closely connected that you cannot have one without the other.

Discriminating

There must be a useful difference between 'good' and 'bad' (Booth 1993). When using a scale there must be clear discrimination between each point on the scale. This is difficult to achieve and is probably the reason why many proprietary audits opt for all-or-nothing (yes/no) questions.

Sensitive

All-or-nothing answers can diminish the sensitivity of an audit. With a graded scale a company can progress to the highest point on the scale over a number of years. With yes/no answers there is instant success or failure.

Verifiable

Verification should be sought for some questions to improve accuracy by eliminating errors caused by misconceptions that things have been done when they have not.

Efficient

The system must be an efficient method of monitoring safety performance from the point of view of the time required to completed the exercise. There is no point in asking 1000 questions if the same information can be determined with just 100.

5.8 Managing the audit

It is important that resources available to carry out the audit are sufficient. Unfortunately it is often unclear in proprietary audits as to what questions need to be answered by which people (this particular point is covered well by SHARP as explained in Chapter 4), what information is required etc. This makes it difficult to decide how many auditors are required and how long the audit will take. Eisner & Leger (1988) reported that the part play in the audit by management and external auditors was unclear. They implied that because of a shortage of external auditors much of the internal audit was not verified.

A good audit should specify exactly what documents are required, who should be interviewed and for which sections of the audit workplace visits are required. It should facilitate systematic and efficient collection of data.

5.9 The use of incident data

It is common for proprietary audits to require a certain level of achievement in the number of incidents reported. This is then taken into account in the final overall audit score. This is the case in both ISRS and QSA. The problem with this approach is that historical data are being included in an assessment of present conditions. There may have been an improvement in the management of health and safety that is not yet reflected in incident data and vice versa.

Rather than incident data, which Dawson et al (1982) called 'hazard outcomes', audits should consider control outcomes. Control outcomes have the advantage over hazard data in that they can be current rather than historical. An example of a control outcome is to establish whether a permit to work system is used rather than just whether it exists which would be classed as a control activity. Using this type of data was also recommended by the ASCNI study group (HSC 1993). As described in Chapter 3 the report called control outcomes key performance indicators or '*Output*' data.

5.10 Results

Having completed an audit it is important that the results can be easily understood and that they are useful for determining any improvements that need to be made. It is recommended by some namely Johnson (ROSPA 1985) and Arnold (1993) that auditors hold feedback sessions at the end of the audit to discuss points which will appear in the final report.

5.11 Features of a successful audit

From the observations discussed in the previous paragraphs in this chapter it was concluded that for an audit to be successful it should contain the features summarised in Table 5.1.

Table 5.1 Features of a successful audit

Scope
Specify which elements of the O&H management system or which hazards have been included.
Auditors
For competent trained persons who are independent of the area being audited.
Training
Training should be directed at teaching interview skills and other audit management techniques. It should not be necessary to explain the questions.
Scoring
Correctly weighted questions.
Questions
Comprehensible, single, discriminating, sensitive, verifiable
Managing the audit
A good audit should specify exactly what documents are required, who should be interviewed and for which sections of the audit workplace visits are required. It should facilitate systematic and efficient collection of data.
Incident data
Rather than incident data (hazard outcomes) audits should consider control outcomes.
Results
Having completed an audit it is important that the results can be easily understood and that they are useful for determining any improvements that need to be made.

CHAPTER 6

Evaluating Audit Systems

6.1 The use of accident statistics

Past evaluations of proprietary audit systems namely the study carried out by Eisner and Leger (1988) discussed in section 6.4, considered it necessary to compare audit scores with accident statistics. Accident statistics also featured strongly in ISRS publicity. The system was claimed to bring about an improvement in accident performance. Thus accident statistics were examined as criteria that could be used to compare different proprietary audits in this research. As serious accidents in most organisations are quite rare it was considered that it would probably be necessary to use lost-time accidents. As Senneck (1975) showed in his studies these are a poor measure of safety performance as they are affected by socio-economic factors. If lost-time accidents were used to evaluate proprietary audits the method could be flawed by relying on an imperfect measure of safety performance. The literature was therefore searched for information on more reliable methods of monitoring safety performance as a means of testing the effectiveness of audits.

6.2 Alternative methods of monitoring safety performance

Research projects have previously been carried out at Aston University on measuring safety performance. These projects were examined to

determine what criteria were used to measure safety performance and whether the researchers had drawn conclusions about the effectiveness of the measures used. Techniques for monitoring safety performance were considered by Buchanan (1976) and Thomas (1981). To measure safety performance in a factory Buchanan used accident frequency rates based on surgery attendance, accident investigations, self-inspection, costing of accidents to departments when this became feasible, damage control and job appraisals. Thomas studied the effect of employee participation on safety performance by examining accident records and statistics, employee attitudes, expenditure on health and safety, activities of supervision, activities of the health and safety committee, activities of the fire safety officer, activities and attitudes of safety representatives and specific cases. Thomas commented that safety performance should be measured by triangulation techniques⁷ and was concerned about the effect of the researcher on performance.

Tarrant (1980) in a book on the measurement of safety performance made a number of observations relevant to audits and methodologies used to evaluate them. For instance it is stated that an excellent system can be developed that tells when a problem exists but does not in itself give any solutions. It is suggested that sometimes the measurement becomes an end in itself instead of providing a valid and reliable index of the safety state of the organisation. A system of checking measurements made is advocated to ensure that results are reliable.

⁷ This term derives from the geographical sciences when it is usually used to denote the practice of taking a minimum of two different measures to gauge the true height of a point above sea level. This practice has been taken up by a number of other disciplines and translates into the principle of not relying upon a single measure to assess something but rather to use a combination of measures (or methods or data) to evaluate for example the effectiveness of a management practice (Glendon, 1994)

Measurement tools considered by Tarrant include the critical-incident technique⁸, near-miss measures and safety sampling. He advocates strongly that in safety measurement it is essential to use multiple predictors and identifies twelve criteria that might be used in safety performance measurement:

- disability (injuries and diseases)
- undesired behaviour (unplanned and planned)
- unsafe conditions
- property damage
- insured costs and uninsured costs
- compensation claims
- production disruption
- scrap costs
- rework costs
- customer complaints
- minor injury or first-aid cases
- absenteeism

6.3 Accident cause analysis

A timely article was published by Waldram (1988) on accident cause analysis. This was considered as a potential method of measuring safety performance that could be used in a workplace comparison for this research. Waldram adapted from the work of Bird and others a system for categorising accidents according to cause, Table 5.1.

⁸ a technique whereby an interviewer questions a number of persons who have performed particular jobs within certain environments and asks them to recall and describe unsafe errors that they have made or observed, or unsafe conditions that have come to their attention

Table 6.1 Systematic Accident Cause Analysis (Waldram 1988)

P	Persons directly involved.
P1	Skill/training/information inadequate.
P2	Personal protective equipment inadequate
P3	'Reasonable' failing
P4	'Unreasonable' failing
E	Equipment and Place of Work
E1	Specification/design/layout inadequate
E2	Manufacture/construction inadequate
E3	Maintenance/operational inspection inadequate
S	Systems of Work
S1	Job arrangements inadequate
S2	General systems inadequate
S3	Worksite inspection inadequate
O	Outside Local Control
O1	Company offsite procedures inadequate
O2	Failure by specialist supplier/contractor
O3	Failure by third party (no contractual relationship)
O4	Severe weather

The accident investigator ticks all the causes relevant to each accident, then analyses the results when enough have accumulated to be statistically significant. Systematic accident cause analysis was used by Waldram to analyse the causes of typical offshore accidents in the North Sea oil industry. The method showed that even where the accident record would be judged satisfactory by traditional statistics, 50% or more of the serious accidents could be prevented by reasonable practicable means. Thus approximately 50% of Lost Time injuries cannot realistically be prevented.

6.4 Previous work on proprietary audits

Only one published paper was found at the start of the research that related specifically to a proprietary audit. This was a paper written by Eisner and Leger (1988) about the use of a mine version of ISRS in South African Mining. Eisner and Leger reported that they were unable to find any published evaluation of ISRS by any university or research laboratory. They therefore attempted to remedy this situation by carrying out a critical review of the version of ISRS adopted by the Chamber of Mines in South Africa. The majority of the paper covers opinions of the rating scheme and how it relates to safety problems in mines. To back up their opinion that the auditing system had a number of flaws they sought to demonstrate that there was no correlation between accident rates and star ratings in ISRS. Numbers of fatalities and reportable injuries for 1985 and 1986 were obtained for 33 gold mines and related to their star ratings. From these results it was concluded that whatever the effect of ISRS on mine safety it did not manifest itself in lower accident rates. At the time in 14 of South Africa's gold mines generally more than 15 people were killed each year, yet 9 of these mines held a 5-star status. For a mine to achieve such an excellent rating but still have a high fatality rate was presumed to be either because the standard set by ISRS was too low or auditing was biased. Although a number of criticisms were made about various elements in ISRS, Eisner and Leger did not from their studies of the ISRS manual believe that the standard set was too low. On the contrary they commented that some elements were too elaborate. They therefore suggested that some mines were obtaining a high star rating

because their auditing was biased and because competition between mines lead to responses to questions that were:

"at best no more than wishful thinking and at worst required falsification of records".

The fact that the mines cheated to achieve some of the audit requirements was supported by Wall (1995).

Since Eisner and Leger's study of a mine version of ISRS in South Africa a number of other papers have been written that attempt to evaluate the effectiveness of ISRS . These publications were reviewed by Glendon (1994) who criticised most of the studies for being cross-sectional rather than longitudinal⁹ and for not being carried out by researchers who were independent of the promoters. Glendon concluded that the value and validity of safety auditing has yet to be established in a scientific sense and that what is required are longitudinal studies of organisations which:

"are sponsored, funded and conducted by agencies which are independent of audit suppliers and marketers;

obtain audit and outcome data over at least a 5-year period, and ideally a 10 -year period;

correlate audit data with specified outcome data which are independently derived e.g. on accidents, absences, ill-health records, damage and other losses;

evaluate the effects of all possible factors upon any statistically significant changes in outcome data;

attempt to evaluate the influence of safety auditing compared with other changes."

⁹measures of relevant variables before and after a change such as the introduction of an audit

Other relevant research includes a study carried out by Smith (HSE 1992) on the development of a model to incorporate management and organisational (M&O) influences in quantified risk assessment. Smith chose ISRS as a tool for measuring the adequacy of M&O influences because it is widely used as an auditing tool and ILCI were willing to furnish details of ISRS for the research programme. A paired comparison technique¹⁰ was used to assess the ranking of the 20 programme elements in ISRS. It was concluded that elements 6 (Task Observation) and 14 (Engineering Controls) are significantly more important than the weightings given in ISRS and conversely that elements 1 (Leadership and Administration), 7 (Emergency Preparedness) and 12 (Health Control) are less important.

6.5 Methodology for this research

The fundamental dilemma when trying to evaluate safety appraisal schemes is that there is no tried and tested accurate method of measuring safety performance against which new methods can be evaluated. Eisner & Leger (1988) compared ISRS star ratings with accident statistics. As an alternative to accident statistics this research considered comparing CHASE and ISRS scores with other measures of safety performance such as those proposed by Tarrant (1980) and Waldram (1988). However, what appeared to be missing in the first instance was information that organisations could use to compare and contrast question set content against their own needs. This research

¹⁰ The presentation of items to respondents in pairs in a randomly selected order (HSE 1992)

therefore sought firstly to design and develop methods for analysing the style and content of proprietary audit question sets.

CHAPTER 7

Print-based Categorisation

7.1 Introduction

The contents of this Chapter were presented to the British Health and Safety Society's (BHSS) Annual Conference in 1991 and published in the BHSS Journal in 1993 (Collison and Booth 1993).

7.2 Categorisation by content

Using the audit manuals for the fourth edition of the International Safety Rating System (ILCI, 1986) and Version 4.0 of the Complete Health and Safety Evaluation (HASTAM, 1987) audit questions were categorised according to the subject matter of the question. This was done by the author placing a single category code alongside each question in the respective manuals. No account was taken of the weighting given to the question.

7.3 Derivation of the categories

A number of different category lists were tried out until a system was developed that was usable for the questions in both audits. To begin with, category systems as shown in Table 7.1 were written and used on the questions.

Table 7.1 Experimental format for categorising audit questions

1. Safety activity explored	General - relevant to all safety activities Health Surveillance First-Aid Welfare Plant and Machinery Tools and Equipment Chemical Substances Food Hygiene Transport Accident Reporting and Investigation Training Fire Precautions Emergency Planning Environmental Pollution and Waste Disposal Promotion of Health and Safety - Campaigns Off-the-job-safety Other
2. Refers to: 2.1 Hazard/Problem Identification	Inspections Audits by External Bodies Consultation with the workforce
2.2 Implementation of Controls	Physical Safeguards PPE Written Procedures Safe Systems of Work Permits to work
2.3 Maintenance of Controls	Preventive Maintenance Testing
2.4 Training: Who For Type How	Review of Procedures Management Supervisors Operators Safety Staff General H & S training Specific Safety Training Length of Course Internal/External
3. Reply to Question requires	Straight yes/no Requires conformity and knowledge of a legal requirement Requires a judgement to be made - adequate, satisfactory Verification required i.e. evidence that records have been kept etc.

The final list of categories used as shown in Table 7.2 was put together by starting with a blank sheet of paper and frankly developing categories to fit the questions.

Table 7.2 Categorisation of the audit questions

TOPIC	No. of questions		% of total	
	CHASE	ISRS	CHASE	ISRS
Software - General	19	2	5	< 1
Policy Statements/Directives	28	20	8	3
Procedures/documentation/registers	4	35	1	6
Safe Systems of Work/Permits to Work	7	2	2	< 1
Staff Competence/Availability	2	10	< 1	2
Management Involvement & commitment	2	23	< 1	4
Workforce involvement/committees	12	21	3	3
Training/Information/general promotion	38	153	10	24
Incentive schemes/contests	2	11	< 1	2
Auditing/reviews/inspections/maintenance	28	71	8	11
Responsibilities/accountability/job descriptions	14	9	4	1
Accident reporting and investigation	20	77	5	12
Physical Hazards - e.g. housekeeping	1	13	< 1	2
Hazards with plant and machinery	36	9	10	1
Hazards associated with tools	13	1	4	< 1
Electrical hazards	0*	1	0*	< 1
Hazards transport/access & egress/ loading	29	0	8	0
Occupational Health General	23	18	6	3
Safe use of Chemicals	19	11	5	2
Noise	1	1	< 1	< 1
Personal Protection Equipment	9	25	2	4
Ventilation	1	1	< 1	< 1
Health Surveillance	8	13	2	2
Welfare and basic hygiene	5	0	1	0
Monitoring of air contaminants	1	1	< 1	< 1
Fire	17	24	5	4
First-Aid	7	16	2	3
Emergency Planning	5	28	1	4
Waste Management & Pollution Control	2	5	< 1	< 1
Off-the-job safety	0	15	0	2
Safety with contractors and visitors	4	0	1	0
Compliance with legal requirements	7	11	2	2
TOTAL No. of Questions	364	627	100	100

* covered under management of energy

As a result of the way the categorisation system was developed it was less structured than earlier versions but had several advantages. It was easier to categorise questions, all the categories on the list were utilised and it was not necessary to have a miscellaneous category for unusual questions. But each question could only be categorised under one heading. For example if a question was about training on electrical safety, a decision had to be made as to whether the question should be coded as being about training or about electricity.

7.4 Results of the content categorisation

The categorisation system with the results for CHASE and ISRS are shown in Table 7.2 and differences and similarities are summarised in Table 7.3. The categorisation showed that in both audits training questions made up the biggest percentage of the audit and that some topics such as noise, ventilation, monitoring of air contaminants and waste management had very few questions.

Table 7.3 Differences and similarities between ISRS and CHASE

ISRS	CHASE
<p>Training questions largest proportion of audit. Emphasis on management involvement and leadership</p> <p>Contractors and Visitors, welfare not covered*</p> <p>Control of specific hazards covered by a physical evaluation, which is basically an inspection checklist.</p> <p>Mainly yes/no questions. Some professional judgement questions on a scale e.g. 0-20</p> <p>Can progress from 1 star on the standard programme to 5 star on the advanced programme. 10 levels</p> <p>No. of questions depends on the level 100 to 600.</p>	<p>Training questions largest proportion of audit. Emphasis on control of certain hazards.</p> <p>Off-the-job safety not included</p> <p>Plant and machinery, tools, vehicles, chemicals, energy covered by specific questions.</p> <p>All yes/no questions, many questions qualified by words such as adequate. Help section given.</p> <p>Can progress to a higher percentage score.</p> <p>Approximately 400 questions</p>

* included in later versions of ISRS

7.5 Sorting into main headings

The categorisation system described in the previous section was not divided up into main areas of safety activity. In order to assess differences in emphasis, for instance between the number of questions on safety organisation and risk control the categories were divided into five main headings:

- prerequisites (policy and organisation);
- hazard identification;
- risk control;
- damage control;
- accident reporting and investigation.

All the categories except for training fitted into one of these five headings. The training questions were assessed to establish which of the five main areas they covered. The results are displayed in Table 7.4, Figure 7.1 and Figure 7.2. They show that ISRS appears to concentrate to a greater extent on safety organisation compared with CHASE, which devotes a greater number of questions to specific risk control measures.

Table 7.4 Break-down of the questions into five areas of safety activity

	No. of questions as a % of the total*	
	CHASE	ISRS
Prerequisites		
Software - General	5	0.3
Policy Statements/Directives	8	3
Written procedures/documentation/inventories/ registers	1	6
Staff Competence/Availability	0.6	2
Management Involvement & commitment	0.6	4
Workforce involvement/committees	3	3
Training/Information/general promotion relating to prerequisites	9	21
Incentive schemes/contests	0.6	2
Responsibilities/accountability/safety in job descriptions	4	1
Off-the-job safety	0	2
Total	32	45
Hazard Identification		
Auditing/reviews/inspections/maintenance	8	11
Training etc. relating to risk identification	0	0
Total	8	11
Risk Control		
Safe Systems of Work/Permits to Work	2	0.3
Physical Hazards - General including housekeeping	0.3	2
Hazards associated with plant and machinery	10	1
Hazards associated with tools	4	0.2
Electrical hazards	0	0.2
Transport/access & egress/ loading etc.	8	0
Occupational Health General	6	3
Safe use of Chemicals	5	2
Noise	0.3	0.2
Personal Protection Equipment	2	4
Ventilation	0.3	0.2
Health Surveillance	2	2
Welfare and Hygiene	1	0
Monitoring of airborne Contaminants	0.3	0.2
Waste Management and Pollution Control	0.6	0.8
Safety associated with contractors and visitors	1	0
Compliance with legal standards/objectives/ policy etc.	2	2
Training/Information/general promotion relating to risk control	1	2
Total	47	20
Damage Control		
Fire	5	4
First-Aid	2	3
Emergency Planning	1	4
Training etc. relating to damage control	0.3	0.3
Total	8	11
Accident Reporting and Investigation		
Accident, dangerous occurrence etc. reporting & investigation	5	12
Training etc. relating to accidents etc.	0	1
Total	5	13

Figure 7.1 Proportion of ISRS devoted to the 5 main topics

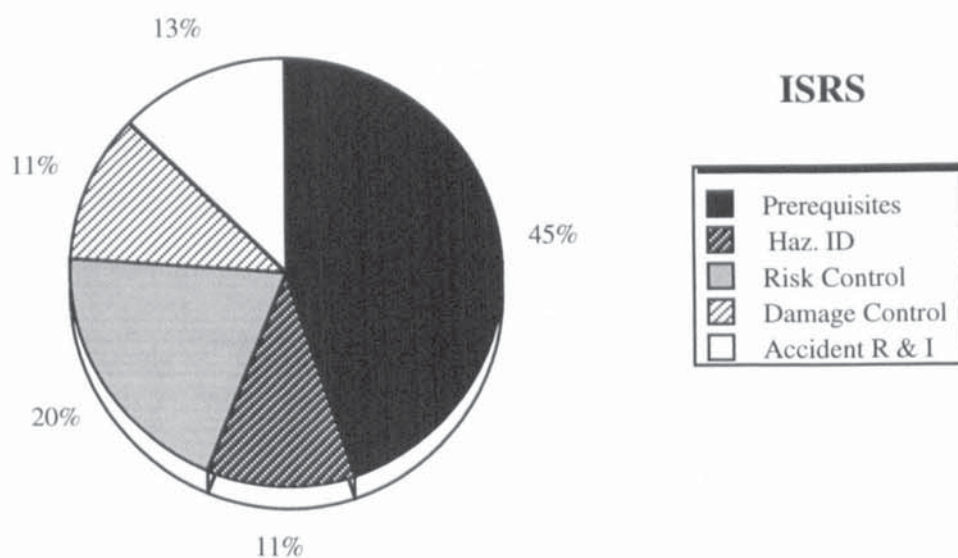
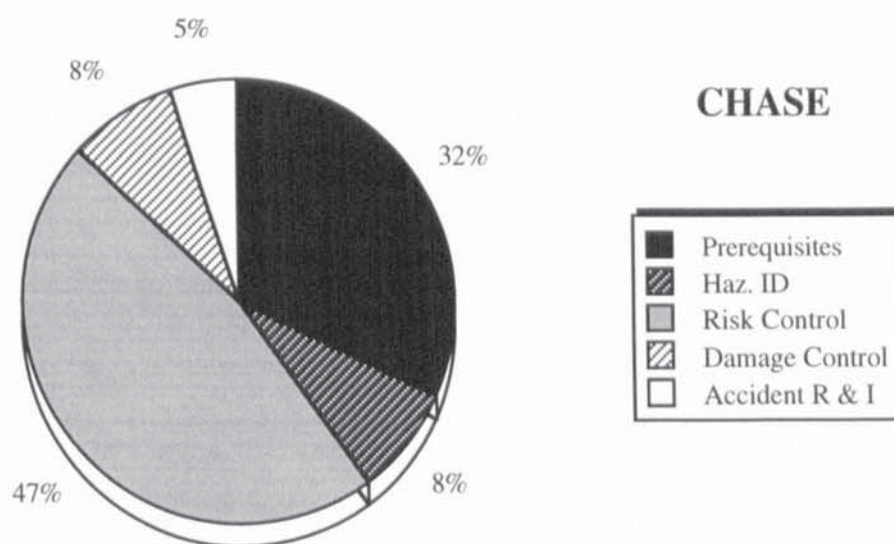


Figure 7.2 Proportion of CHASE devoted to the 5 main topics



7.6 Conclusion

This work showed that it is possible to design a usable classification system for audit questions. The classification system was useful for recognising differences and similarities between two proprietary audits. But it would have been desirable to tag questions as belonging to more than one category in many instances.

CHAPTER 8

Artificial Intelligence and Word Profiling

8.1 Introduction

The categorisation discussed in the previous chapter that will be referred to hereafter as the 'print-based categorisation' was subjective. It relied on a judgement being made as to which category to place each question. It was also very time consuming, to compare CHASE and ISRS nearly 1000 questions had to be analysed. A technique was sought that was more objective and quicker.

8.2 Artificial Intelligence

Artificial Intelligence (AI) is the study of how to make computers do things which, at the moment, people are better (Rich 1988). An expert system is a computer program that can solve a problem that normally can only be tackled by an expert who has accumulated the required knowledge. The construction of expert systems is referred to as knowledge engineering and expert systems rely on a large database of knowledge.

As categorisation of audit questions required knowledge to assess what the question was about, it was envisaged that it might be possible to use

AI techniques to sort questions. An inexpensive expert system shell for a Macintosh computer was purchased. An expert system shell is a complete expert system less the unique rules of the application. The application in this case would be the sorting of audit questions.

Initial experiments with the shell called 'Instant-Expert' supplied by A.I.I.T. Ltd. showed that it could be used for sorting questions. An example of how the system could be made to work is shown in Table 8.1.

Table 8.1 Testing a hypothesis with an expert system shell

VERIFY HYPOTHESIS : Expert Trial One	
The question contains the word ventilation ?	No
The question asks about a safe system of work ?	No
The question contains the words personal protection equipment ?	No
The question contains the words machinery guarding ?	Yes
The question is about control	
The hypothesis the question is about control has been established (True).	

As the knowledge that was being put into the system was to do only with the existence of key words it was decided that sorting could be achieved with word searching computer software.

8.3 Word profiling

A word profiler in an application called 'Grammatik' produced by Riva Limited was used. This could count all the words in a document in a matter of minutes and list them in alphabetical order, in order of the most frequent or the least frequent.

The questions from CHASE II version 4.1 and the fifth edition of ISRS were entered into Microsoft Word files. Version 4.1 of CHASE and the fifth edition of ISRS are both later versions of the audits than those used in the print-based categorisation. The numbers of words in each of the files was counted by:

- opening the Word Profiler in the application Grammatik;
- opening the Microsoft Word audit file from the Word Profiler file menu;
- choosing the order of count required from the Word Profiler, profile menu;

The word profile obtained for ISRS is shown in Appendix 1 and the profile for CHASE in Appendix 2.

8.4 Assessment of the word profiles

Words which were considered characteristic of each audit were as follows:

Key words for ISRS

appropriate	inspections
audiometric	investigations
chemical	lock-out
compliance	machinery
control	management
disposal	near-miss
emergency	noise
employee	off-the-job
energy	policy
environmental	posters
equipment	procedures
fires	records
first-aid	respirators
guarding	training
hazards	ventilation
hygiene	waste
ill	written

Key words for CHASE

adequate	maintenance
appropriate	medical
arrangements	monitoring
chemicals	permit-to-work
contractors	plant
control	policy
disposal	procedures
emergency	representatives
employees	screening
energy	statutory
fire	substances
flammable	surveillance
guards	systems
hazard	tools
hygiene	training
legislation	vehicle
machinery	written

This information alone was not sufficient for making any assessment of the audit content. It was considered necessary to associated each of the key words with a topic category such as those used in the previous chapter.

8.5 Allocation of key words to a topic category

Key words were chosen that were considered to represent each of the categories in the previous print-based system. These categories are listed in Table 8.2. The key words allocated to each of these categories with the frequency of occurrence in each audit is given in Table 8.2. The weighting given to the various topics by counting key words is shown in Table 8.3.

Table 8.2 Print-based categories

<i>Group</i>	<i>Topic Category</i>
1	Software - general
2	Policy statements/directives
3	Procedures/documents/registers
4	Safe systems of work/permits to work
5	Staff competence/availability
6	Management involvement
7	Workforce involvement
8	Training/information/general promotion
9	Incentive schemes/contests
10	Audit/review/inspect/maintain
11	Responsible/accountable/job description.
12	Incident reporting and investigation
13	Physical hazards
14	Hazards with plant and machinery
15	Hazards associated with tools
16	Electrical hazards
17	Transport/access & egress/ loading
18	Occupational health general
19	Safe use of chemicals
20	Noise
21	Personal protection equipment
22	Ventilation
23	Health surveillance
24	Welfare and basic hygiene
25	Monitoring of air contaminants
26	Fire
27	First-aid
28	Emergency planning
29	Waste management
30	Off-the-job safety
31	Safety with contractors and visitors
32	Legal compliance

Table 8.3 Key words and their frequency for CHASE and ISRS

Group		CHASE	ISRS	Group		CHASE	ISRS
		No. of words				No. of words	
1	none	0	0	14	plant	12	0
2	policy	21	15		machinery	8	4
	directive	0	7				
3	procedure	17	81	15	tools	14	1
	document	0	0		equipment	37	62
	register	8	0	16	electrical	1	1
	documentation	0	0		electricity	0	0
4	system	19	32	17	transportation	0	1
	permit	3	5		access	5	0
5	staff	1	0		egress	1	0
	competence	0	0		loading	2	0
6	management	4	110		accessibility	0	2
	involvement	0	0		accessible	0	2
	commitment	0	0		unloading	2	0
7	representative	6	4		transport	1	0
	workforce	0	0		transported	1	0
	committee	2	13		transporters	1	0
8	training	19	79	18	health	73	175
	information	10	18	19	chemicals	4	2
	instruction	1	13	20	noise	1	2
	orientation	0	1	21	protective	18	29
	poster	0	5		equipment	37	62
9	incentive	1	0		respirators	0	4
	contest	0	4		clothing	4	0
	competition	0	5		protection	0	10
10	auditing	1	0	22	ventilation	0	0
	review	1	4	23	medical	5	14
	inspection	5	28		surveillance	3	0
	maintenance	14	11		biological	0	5
	reviewed	4	16		checks	0	0
	assessments	1	0		examinations	0	0
	reassessment	1	0	24	welfare	0	0
	audit	1	34		hygiene	2	5
	preaudit	0	1	25	air	2	2
11	responsibility	6	4		contaminants	0	0
	accountability	0	0	26	fire	10	3
	job	3	13	27	first-aid	1	19
	description	2	1		first	5	5
12	reporting	6	12		aid	2	2
	reports	0	37	28	emergency	7	36
	investigate	1	2	29	wastes	2	0
	investigation	4	7		waste	1	6
	accidental	0	2		pollution	0	1
	accident	2	66	30	off-the-job	0	20
	diseases	0	0	31	contractor	0	0
	occurrences	4	0		contractors	4	1
	dangerous	2	0		visitor	0	0
13	housekeeping	1	7		visitors	1	0
	cleanliness	0	1	32	standards	7	35
	tidiness	0	0		regulations	10	6
					mandatory	0	0
					legislation	7	9
					rule	1	6

Table 8.4 Categorisation of the audits by word count

CHASE		ISRS	
Topic - <i>Most frequent first</i>	No. of words	Topic - <i>Most frequent first</i>	No. of words
Occupational health general	73	Occupational health general	175
Hazards associated with tools	51	Incident reporting & investigation	126
PPE	51	Training, information, promotion	116
Training, information, promotion	30	Management involvement	110
Audit/review/inspect/maintain	28	Audit/review/inspect/maintain	94
Procedures/documents/registers	25	PPE	85
Legal compliance	25	Procedures/documents/registers	81
Safe systems of work/permits	22	Hazards associated with tools	63
Policy statements	21	Legal Compliance	56
Hazards with plant & machinery	20	Safe systems of work/permits	37
Incident reporting & investigation	19	Emergency planning	36
Transport/access & egress/loading	13	Fire	31
Responsible/accountable/job description.	11	First-aid	26
Fire	10	Policy statements	22
Workforce involvement	8	Off-the-job safety	20
Health surveillance	8	Health surveillance	19
First-aid	8	Responsible/accountable/job Description.	18
Emergency planning	7	Workforce involvement	17
Safety with contractors & visitors	5	Incentive schemes/contests	9
Management involvement	4	Physical hazards	8
Safe use of chemicals	4	Waste management	7
Waste management	3	Transport/access & egress/loading	5
Welfare & hygiene	2	Welfare & hygiene	5
Monitoring of air contaminants	2	Safety with contractors & visitors	5
Staff competence	1	Hazards with plant & machinery	4
Incentive schemes/contests	1	Safe use of chemicals	2
Noise	1	Noise	2
Physical hazards	1	Monitoring of air contaminants	2
Electrical hazards	1	Electrical hazards	1
Software general	0	Software general	0
Ventilation	0	Staff competence	0
Off-the-job safety	0	Ventilation	0

8.6. Topic weighting by word profiling

Occupational Health came out on top in both CHASE and ISRS because the word 'health' had been used as a key word. Health appears many times in the audits linked with safety and is not representative of questions to do with occupational health. Similarities between the weighting of topics by word profiling and those by using the method described in Chapter 7 were apparent. The correlation between the two methods was investigated by assessing whether the ranking of topics in the print-based categorisation compared with the rankings given by word profiling.

8.7 Comparison of word profile with print-based categorisation

The print-based categorisation percentages were numbered 1 to 9 e.g. 1 for categories covered by more than 10% of the audit questions, 9 for categories with zero questions. Only 9 rankings were required to cover the range of percentages. For the word profile results there was more than 9 different numbers of words. The results were therefore put into nine groups as shown in the Table 8.5. For instance the category 'training/information/promotion' in CHASE with 30 words had a ranking of 3. The ranking of all the topics according by this method is given in Table 8.6.

Table 8.5 Ranking groups

Ranking	No. of words CHASE	No. of words ISRS	Percentage of questions in CHASE	Percentage of questions in ISRS
1st	>55	>100 = 1	10	24
2nd	55-35	100-75	8	12
3rd	34-25	75-50	6	11
4th	24-20	49-20	5	6
5th	19-15	19-15	4	4
6th	14-10	14-10	3	3
7th	9-5	9-5	2	2
8th	4-1	4-1	1	1
9th	0	0	0	0

8.8 Results of comparison

'Noise', 'electrical hazards', 'ventilation' had appeared as topics with few questions in the first categorisation and by key word a similar result was given. CHASE had more words associated with 'hazards of plant and machinery' than ISRS. Management involvement and commitment came very high up the list in ISRS whereas in CHASE it was nearer the bottom of the list. However, there were also some anomalies, for instance 'safe systems of work' and 'permits to work' which in the print-based categorisation accounted for less than 1% of the audits was much higher up in the word count table. This may have been because there were more questions on this topic in the later editions of the audits but more importantly because of the use of the word 'system' in the search. 'System' like 'health' tends to appear many times in the audits but not always in the phrase 'safe systems of work'.

Table 8.6 Rankings by different methods of categorisation

TOPIC	Rankings 1-9 (1 most frequent - 9 least frequent)			
	CHASE		ISRS	
	Print-based	Word Count	Print-based	Word Count
Software - General	4	9	8	9
Policy Statements/Directives	2	5	6	4
Procedures/documentation/registers	8	3	4	2
Safe Systems of Work/Permits to Work	7	4	8	2
Staff Competence/Availability	8	8	7	9
Management Involvement & commitment	8	8	5	1
Workforce involvement/committees	6	7	6	5
Training/Information/general promotion	1	3	1	1 ¹¹
Incentive schemes/contests	8	8	7	7
Auditing/reviews/inspections/maintenance	2	4	3	1
Responsibility/accountability/job descriptions	5	6	8	5
Accident reporting and investigation	4	5	2	1
Physical Hazards	8	8	7	7
Hazards with plant and machinery	1	4	8	8
Hazards associated with tools	5	2	8	3
Electrical hazards	9	8	8	8
Hazards transport/access & egress/ loading	2	6	8	7
Occupational Health General	3	1	6	1
Safe use of Chemicals	4	8	7	8
Noise	8	8	8	8
Personal Protection Equipment	7	2	5	2
Ventilation	8	9	9	8
Health Surveillance	7	7	7	5
Welfare and basic hygiene	8	8	9	7
Monitoring of air contaminants	8	8	8	8
Fire	4	6	5	4
First-Aid	7	7	6	4
Emergency Planning	8	7	5	4
Waste Management & Pollution Control	8	8	8	7
Off-the-job safety	9	9	7	4
Safety with contractors and visitors	8	7	9	9
Compliance with legal requirements	7	3	7	8

¹¹ A perfect correlation was achieved when the ranking figures were the same in the print-based categorisation and the word count e.g. as for training/information/general promotion in ISRS

8.9 Word profiles on selected parts of the audits

To gain further information about how well certain words represented a category a separate word profile was obtained for each group of questions. This involved separating each group of questions from the rest of the audit so that its own word profile could be obtained. The word profile for the group of questions in the category 'Incident reporting and investigation' is shown in Table 8.7 compared with the same words in the audit as a whole. The procedure was not completed for all of the ISRS questions because of problems associated with changing the version of ISRS used between the print base categorisation and the word profiling system. In the results Table 8.8 those groups which were not assessed are marked 'n/a' for data not available.

Table 8.7 Keywords in a topic group compared with the complete profile for all questions

<u>Incident reporting & investigation</u>	No. of words in topic group for ISRS	No. of words in whole audit ISRS
reporting	6	12
reports	2	27
investigate(d)	1	2
investigation(s)	16	35
accidental	0	2
accident(s)	21	66
diseases	0	0
occurrences	0	0
dangerous	0	0
TOTAL	46	144

Table 8.8 Group profiles compared with the complete audit profile

Topic	CHASE		ISRS	
	No. of words		No of words	
	Whole	Part	Whole	Part
Software general	0	6	0	0
Policy statements	21	12	22	8
Procedures/documents/registers	25	1	81	6
Safe systems of work/permits	22	5	37	n/a
Staff competence	1	0	0	0
Management involvement	4	4	110	6
Workforce involvement	8	12	17	5
Training, information, general promotion	30	6	116	70
Incentive schemes/contests	1	3	9	7
Audit/review/inspect/maintain	28	7	94	31
Responsibilities/accountability/job description.	11	3	18	5
Incident reporting and investigation	19	5	126	46
Physical hazards	1	1	8	7
Hazards with plant & machinery	13	20	4	n/a
Hazards associated with tools	51	26	63	n/a
Electrical hazards	1	n/a	1	n/a
Transport/access & egress/loading	13	20	5	n/a
Occupational health general	73	12	175	12
Safe use of chemicals	4	9	2	0
Noise	1	1	2	2
PPE	51	30	85	40
Ventilation	0		0	0
Health surveillance	8	6	19	10
Welfare & hygiene	2	3	5	n/a
Monitoring of air contaminants	2	2	2	n/a
Fire	20	13	31	17
First-aid	8	7	26	n/a
Emergency planning	7	4	36	18
Waste management	3	2	7	0
Off-the-job safety	0	0	20	13
Safety with contractors & visitors	5	4	1	n/a
Legal compliance	25	4	56	n/a

n/a data not available

8.10 Group word profiling results

The results of the group word profiling showed that there was generally a poor correlation between the groups and the audit as a whole. This was considered to be because some important key words had been missed out and because in the print-based categorisation the questions could only be placed in one category. To establish whether key words were missing further analysis was carried out on the 'incident reporting and investigation' group. The profile for the group is shown in Table 8.9 and confirms for this group anyway that a number of important key words had been missed out.

Table 8.9 Key words for the 'Incident reporting and investigation' group

Key Word	Frequency
accident (s)	21
incident (s)	16
report (s), reported, reporting	13
injury , injuries	6
illnesses	5
medical	5
damage	4
causal, cause, causes	3
near-miss, near-misses	2
analysis	1
investigated, investigation(s), investigator	1
non-disabling	1

Words in bold are those not originally included as key words in the search

8.11 Word profiling as a categorisation technique

Word profiling had the advantage that it was very quick but there were concerns about the accuracy of the technique. Although overall word counting appeared to match quite well with the print-based system it was a cause for concern that there was such a poor match between the group counts and the audit as a whole. It was considered that a technique was needed that could count phrases as well as words and was more amenable to checking which words were in which questions.

CHAPTER 9

Workplace Assessment

9.1 Objective

A brief trial was carried out to determine if useful information about the style and content of proprietary audits could be obtained by using the audits to measure safety performance in the workplace. The company chosen for the trial was a small Nuneaton based engineering company belonging to a larger group of companies. Six months before the trial a merger had taken place with another group company based in Sheffield. This had resulted in redundancies at the Nuneaton factory, shut-down of the whole heat treatment section and transfer of many administrative tasks to Sheffield. The company had no full time safety co-ordinator. Safety functions were shared by the management team. A safety representative had been appointed by the Trade Union.

9.2 Methodology

ISRS and CHASE were used to conduct an audit of the site. The Works Manager was given a sample of approximately 10 questions from each audit to see if it was feasible to leave the audits with him for completion. It was found that he could answer the more prescriptive ISRS questions more easily than the CHASE questions. However, the answer for the ISRS questions was usually 'No' as the questions seemed too onerous for the company. As the Works Manager had

some difficulties with the questions it was agreed that the author should act as auditor and that the Work's Manager should assist by gathering together various information to facilitate completion of the audit questions. A list of information required was compiled and is given in Table 9.1.

Table 9.1 Information for completing the audits

1. Health and safety policy.
2. Management training.
3. Operator training.
4. Chemicals COSHH assessments.
Material data sheet files.
5. Health and safety committee minutes.
6. Safety representatives - who has been appointed (shown on minutes), their training?
7. Fire certificates.

Fire fighting equipment serviced by Thorn. Fire alarm/manual operation - drills, two years probably.

Security - burglar alarm to security company. Factory open 24 hours.
8. Accident books, forms sent to HSE, etc.
9. First-aid - how persons (volunteers) are appointed, training, etc. (by either St. John's or Red Cross, to statutory requirements) .
10. Factory inspector's report.
11. Statutory inspections by insurance company - John Vale, Fire Insurers.

After two weeks the Works Manager had collected most of the information and a meeting with other members of staff was arranged. This meeting was extremely useful in establishing the present situation as regards Health and Safety arrangements in the company.

9.3 Completion of CHASE

Using the safety policy, the chemical register and other information gained from the meeting, 52% of CHASE II Version 4.1 audit questions could be completed. The scores obtained were :

Management of Legal Requirements and Resources	35%
Management of Tools, Equipment, Fixtures and Fittings	34%
Management of Machinery and Plant	16%
Management of Chemicals and Substances	29%
Management of Vehicles	35%
Management of Energy	26%
Management of Health	44%
Management of Tasks	7%
Management of People	38%
Monitoring and Feedback for Health and Safety	27%
Management of Change	0%
Management of Emergencies and Special Cases	6%
Overall Score	27%

The highest score obtained was for the Management of Health. The overall score obtained was 27%. The company scored particularly poorly on:

- Management of Tasks
- Management of Change
- Management of Emergencies
- Management of Machinery and Plant

This was because the company had no written safe systems of work and no permit to work arrangements. When changes were made no formal arrangements existed for assessing health and safety implications. The fire certificate had not been updated and fire drills/training had not been carried out.

On machinery and plant a poor score was obtained because the information required to answer the questions was not available. The questions required an input from someone who was responsible for machinery. The following questions are given as examples:

"Are you familiar with the relevant regulations and standards for the safety of your machines"?

Does inspection and maintenance of interlock guards ensure that there is no evidence of tampering? " (HASTAM 1989)

A relatively high score was obtained for the 'Management of Health'. This was due to the inclusion in the section of first-aid which was managed exceptionally well by the company.

9.4 Completion of ISRS

ISRS is arranged in ten steps or levels of achievement. The company was audited to determine if they could obtain the first level of achievement 'one star on the standard programme'. This involved answering about 50 questions. Only three questions proved difficult to answer, these were:

"Are all questions, materials used, stored or manufactured in the workplace properly labelled?"

Are specific pre-placement medical examinations carried out as required by legislation (i.e. audiometric tests, etc.) where certain health hazards are present in the work place?

Are employees' health records maintained and stored in a permanent confidential file and/or as required by legislation?"
(ILCI 1988)

The first question required a workplace inspection and the other two questions were not applicable. The company was not recruiting and so no pre-placement medicals were carried out. The company did not carry out health surveillance on employees and therefore had no health records.

The individual element scores for ISRS were as follows:

Leadership and administration	30%
Planned inspections	0%
Accident/incident investigation	0%
Emergency preparedness	27%
Organisational rules	0%
Employee training	0%
Personal protective equipment	42%
Health control	26%
Purchasing	50%
Average	17.5%

The average required for a one star rating is 25%. The company obtained an average score of 17.5% and therefore did not obtain the minimum attainment level of ISRS. A zero score was obtained for planned inspections, accident/incident investigation, organisational rules, and employee training because:

- no planned health and safety inspections were carried out;
- there was not a preventative programme;
- accidents/incidents were reported but there was no formal procedure for investigation;
- there were no written health and safety rules;
- the company had no training programme.

9.5 Comparison of ISRS and CHASE

In general the ISRS questions were easier to answer than the CHASE questions because they were more prescriptive i.e. required less professional judgement. The number of times CHASE used the term appropriate arrangements made the audit difficult to use.

A table was constructed that ranked the percentage scores achieved in the different sections of the audit, Table 9.2. The highest percentage score in ISRS was compared with highest percentage score in CHASE to ascertain if there was any similarity in the topics. However, the results for ISRS and CHASE were quite different. Based on the results of ISRS the company would be steered to improving planned inspections, accident/incident investigation, organisational rules and employee training. Using the CHASE results the company might look at management of tasks, management of emergencies and special cases and management of change.

Table 9.2 Comparison of ISRS results with CHASE

ISRS (1 star/standard)	%	CHASE II	%
Purchasing	50	Health	44
PPE	42	People	38
Leadership & administration	30	Legal requirements and resources	35
Emergency preparedness	27	Vehicles	35
Health control	26	Tools, equipment, fixtures & fittings	34
Planned inspections	0	Chemicals and substances	29
Accident/incident investigation	0	Feedback for health and safety	27
Organisational rules	0	Energy	26
Employee training	0	Machinery and plant	16
		Tasks	7
		Emergencies and special Cases	6
		Change	0

9.6 Conclusions from the trial

The trial showed that:

1. words such as 'appropriate' made the questions more difficult to answer;
2. where further information is required to answer a question this should be given in the text and not as an appendix;
3. highly prescriptive questions were easy to answer but for this particular organisation usually resulted in a 'no' response. This could have a de-motivating effect. An audit should try to pitch in at the right level;
4. when questions require a visual inspection of plant and equipment then the auditor must be warned that this is required and instructed to do this;
5. when questions can only be answered by a certain person some indication of this must be given in the audit;
6. it was possible to obtain quite high scores on some sections of the audits because the company performed well in one specific topic e.g. in management of tasks, a poor performance on safe systems of work could be cancelled out by a very good performance on job descriptions;
7. the results from the audits were different but just how different was impossible to ascertain using the main section headings. Further breakdown of the sections by categorising the questions would help in the identification of similarities and differences.

It showed that if future studies were to be carried out that it would be necessary to use organisations that were already committed to using a proprietary audit. In this study it was not feasible to leave the question sets with the company for completion. They were not motivated to complete the questions themselves although they were quite willing to help. The workplace assessment provided a reminder that proprietary audit systems are not necessarily or ever a means of motivating an uncommitted organisation. Proprietary audits provide a means to allow committed organisations to focus and prioritise their OH&S management efforts.

The workplace assessment did not show the way forward for future studies in the workplace. The aim of the research was to assess the style and content of audit questions. It was considered that this could be done by developing the categorisation systems discussed in Chapters 7 and 8 rather than by obtaining further information through field work. The trial showed that criteria such as prescription and use of professional judgement in audit questions are important. It also showed that to determine similarities and differences in audits it is necessary to examine the questions rather than just compare section headings.

CHAPTER 10

Multi-tagging

10.1 Introduction

The print-based categorisation discussed in Chapter 7 had only allowed each question to be put into one category. For some questions it was quite difficult to decide what the question was predominately about. The next method of categorising therefore was designed to allow multi-tagging of questions. As all the audit questions had been entered into a computer file for word profiling the multi-tagging was done using the word-processing application Microsoft Word. The questions were put into a table and for each category another column was added to the table. There were three main options in the design of the categorisation:

- to have a large number of categories or columns in the table
- to have just a few categories but very many options to choose from within in each category
- to have a relatively small number of categories and just a few options to choose from in each category

The preferred method was to have as small a number of categories as possible and not to generate information that would be unusable. However, it was important that each question fitted into at least one of

the categories and that each question was fully described by the criteria chosen.

10.2 Assessment criteria

What was required was a framework or model into which all audit questions could be fitted. Models of OH&S such as that given by HSE (1991) and ACSNI (HSC 1993) detailed in Chapter 2 were explored to find out if these would be a suitable starting point. Other criteria examined were 'Elements of Competence' for Occupational Health and Safety Practitioners issued by the lead body for establishing Nationally Accredited Occupational Standards and Vocational Qualifications (NVQ) (1993) and forms used for the reporting of accidents to the enforcing authorities (form F2508) under the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1985 (Great Britain, 1985).

10.3 Categorisation using models of OH&S management

The OH&S management models are attractively simple but it was found to be difficult to classify audit questions in terms of the elements in the model. The reason for this was linked to research carried out by Mintzberg (Evans 1992). Mintzberg showed that the actual day-to-day activities of managers are rarely described in terms of setting objectives, planning etc. If health and safety audits look at actual control activities then it follows that it may also be difficult to describe these activities in terms of elements such as planning in a model.

10.4 Categorisation by NVQ function

Experimental work was carried out with the NVQ (1993) lead body's draft function categories for occupational health and safety practitioners (OHaSPs). This was because the OHasPs categories were thought to cover the scope and boundaries of occupational health and safety, similar to what was required to sort audit questions. The NVQ categories are listed in Table 10.1.

The categories were not very easy to use and it was found that the resulting code for the question was often far too general. For example the only code considered suitable for the CHASE II question:

"7.3. g Do all employees have pre-employment screening?"
(HASTAM 1989)

was 'C34 - to implement risk control measures'. It was considered that this code was too general and therefore did not fully describe the question.

Table 10.1 Function categories for OHaSPs (NVQ 1993)

A1	Provide support for the control of risk
A11	Provide information and advice
A12	Contribute to problem solving
A13	Facilitate Group working
B1	Establish and maintain OHS policies
B11	Collect relevant data
B12	Determine & maintain policy and organisational arrangements
B13	Communicate policies and organisational arrangements
B14	Contribute to specification of OHS responsibilities
C1	Establish, maintain and develop OHS systems
C11	Establish and maintain OHS systems
C12	Implement OHS systems
C13	Evaluate and develop OHS systems
C2	Assess requirements for risk control
C21	Identify hazards
C22	Evaluate risks
C3	Plan, implement and develop risk control
C31	Define risk control objectives and methods
C32	Plan risk control activities
C33	Recommend resources for risk control
C34	Implement risk control measures
C35	Evaluate and develop risk control measures
C36	Develop, test and maintain emergency procedures
D1	Establish & maintain a culture of OHS awareness
D11	Promote & support management commitment to OHS
D12	Contribute to OHS consultation process
D13	Contribute to resolution of OHS related conflict
D14	Raise awareness of OHS through publicity
E1	Regulate OHS operations
E11	Identify relevant legislation
E12	Identify compliance shortfalls
E13	Identify improvement areas
E14	Implement action for improvement
E15	Monitor improvement action
F1	Identify organisational training and development needs
F2	Identify current competencies of individuals
F3	Prepare and present demonstrations and information
F4	Evaluate the achievement of training outcomes
G1	Contribute to the implementation of change
G2	Create maintain and enhance working relationships
G3	Seek, evaluate and organise information for action
G4	Exchange information to solve problems and make decisions
H1	Contribute to advances in OHS
H11	Contribute to advances in OHS practice
H12	Provide information and support to enable others to contribute to advances in OHS
H13	Evaluate advances in OHS
H14	Promote advances in OHS

10.5 Development of a category list

As existing lists of health and safety functions and OH&S management elements were not suitable for coding audit question sets a new list was compiled in collaboration with Booth (1993b) . This list of categories is given in Table 10.2.

Table 10.2 Multi-tagging categories

Question character?

- 0.1 Probing index HIGH/MODERATE/LOW
- 0.2 Prescription index HIGH/MODERATE/LOW
- 0.3 Marginal utility index GOOD/MODERATE/LOW
- 0.4 Score chasing/audit mismatch index GOOD/MODERATE/POOR
- 0.5 Clarity index GOOD/MODERATE/POOR
- 0.6 Relevance index HIGH/MODERATE/LIMITED APPLICATION
- 0.7 Multiple requirement index SINGLE/TWO/MULTIPLE

1 Corporate health and safety organisational functions?

- 1.1 Preparation/implementation of health & safety policy/plans?
- 1.2 Monitoring and/or review of policy/plans?
- 1.3 Creation/maintenance of Information Systems?
- 1.4 Communication/consultation?
- 1.5 Health and safety committees?
- 1.6 Personal responsibilities?
- 1.7 Selection and/or training?
- 1.8 Personal health and safety performance review/feedback?
- 1.9 Hazard Management?
- 1.10 Activities that promote/demonstrate corporate/senior management commitment?
- 1.11 Activities that promote/demonstrate employee commitment?
- 1.12 Other organisational/functional issues not listed above?

2 People?

- 2.1 Directors?
- 2.2 Managers?
- 2.3 Supervisors?
- 2.4 All employees/employees not specified?
- 2.5 Operatives?
- 2.6 New personnel an/or personnel with new responsibilities?
- 2.7 Young persons?
- 2.8 Health and safety specialists?
- 2.9 Competent/expert persons?
- 2.10 Health and safety representatives?
- 2.11 Contractors and/or contractors' personnel?
- 2.12 Persons other than employees?
- 2.13 The public (including visitors)?
- 2.14 Other persons/groups not listed above?

3 The Workplace?

- 3.1 Buildings and/or work areas?
- 3.2 Fixed plant and/or machinery?
- 3.3 Processes?
- 3.4 Transport?
- 3.5 Energy sources?
- 3.6 Equipment/tools?
- 3.7 Storage facilities?
- 3.8 Materials?
- 3.9 Substances?
- 3.10 Other aspects of the workplace not listed above?

4 Work Activities?

- 4.1 Work activities/tasks (Gen.)
- 4.2 Designing and/or planning?
- 4.3 Construction and/or demolition?
- 4.4 Installation and/or commissioning?
- 4.5 Operation?
- 4.6 Maintenance and/or repair?
- 4.7 Materials etc. handling?
- 4.8 Other activities not listed above?

5 Hazard Management Procedures?

- 5.1 Incident investigation?
- 5.2 Injury accident investigation?
- 5.3 Exposure measurement and/or analysis?
- 5.4 Workplace (hardware) inspections?
- 5.5 Workplace (behavioural) inspections?
- 5.6 Workplace inspections (general)?
- 5.6 Hazard identification procedures?
- 5.7 Risk assessment/decision procedures?
- 5.8 Implementation of controls?
- 5.9 Monitoring and/or review of controls?
- 5.10 Other hazard management procedures not listed above?

6 Hazards?

- 6.1 Hazards (not specified)?
- 6.2 Slips/falls?
- 6.3 Struck or crushed by ... ?
- 6.4 Contact with .. ?
- 6.5 Electricity?
- 6.6 High pressure fluids?
- 6.7 Fire and/or explosion?
- 6.8 Substances hazardous to health?
- 6.9 Asphyxiation?
- 6.10 Noise and/or vibration?
- 6.11 Working conditions that may promote WRULDs?
- 6.12 Inadequate thermal environment?
- 6.13 Other hazards not listed above?

7 Hazard Control Measures?

- 7.1 Hazard elimination or reduction?
- 7.2 Physical barriers and/or enclosure?
- 7.3 Ergonomic design?
- 7.4 Safe systems of work?
- 7.5 Permit-to-work procedures?
- 7.6 Training?
- 7.7 Instruction and/or supervision?
- 7.8 Personal protective equipment?
- 7.8 Emergency procedures?
- 7.9 Emergency equipment?
- 7.10 Other hazard controls not listed above?

8 Statutory Requirement?

- 8.1 Health and Safety at Work Act 1974
- 8.2 Management of Health and Safety at Work Regulations 1992
- 8.3 Industry-specific acts/regulations?
- 8.4 Hazard-specific acts/ regulations?
- 8.5 Control measure-specific acts/ regulations?
- 8.6 Reporting/notification acts/ regulations?
- 8.7 General reference to legal requirements?
- 8.8 Other acts/regulations not identified/ characterised above?

10.6 Use of the coding system

Under the multi-tagging categorisation the CHASE II question

"7.3. g Do all employees have pre-employment screening? "

(HASTAM 1989)

was coded (excluding the question character element) as:

- 1.7 Selection and/or training
- 2.4 all employees/employees not specified and
- 7.10 other hazard controls not listed above.

The coding system was workable but problems were occurring with the computer. The size of the table in Microsoft Word was too large. It was slow to work with and there were concerns about how the information would be sorted once all the questions had been categorised.

10.7 Change to use of a database

Sorting hundreds of questions into nearly 100 different categories required the use of a spreadsheet or a database. Even with this software the task of sorting the questions would be very time consuming unless word profiling techniques could be used. To enable word searches to be carried out and to sort a lot of data efficiently it was considered that it was necessary to have a database. The database categorisation is discussed in Chapter 12.

10.8 Control outcomes and prescription categorisation

Prior to developing a database categorisation a simpler coding system was tried out to assess how prescriptive the questions were and whether they looked at control activity or control outcomes as defined by Dawson (1982). Using word processing software a table was created and the questions coded according to the following criteria:

Category 1

There were two options to choose from:

Option 1 - System indicating that the question required performance of an activity or condition dictated by the audit.

Option 2 - Legal indicating that the audit question required compliance with a legal requirement

Category 2

This category looked at whether a value judgement had to be made.

Option 1 - the question required professional judgement

Option 2 - the question did not require professional judgement

Category 3

This category aimed to seek out any questions which appeared to be addressing achievement in risk control rather than just activity.

Option 1 - the question looks at control outcomes

Option 2 - the question addresses control activity only

Category 4

This was a listing of the written documentation required if any to achieve a yes answer to the question.

10.9 Results of the activity and prescription categorisation

The results are summarised in Table 10.3 and Table 10.4.

Table 10.3 Categorisation for prescription and activity outcomes for CHASE

Category 1 System/Legal	Category 2 Professional Judgement (PJ)	Category 3 Activity/ Outcomes	Category 4 Written Documentation
System 97 % Legal 3%	PJ 45%	Activity 89% Outcomes 11%	See Table 10.5

Table 10.4 Categorisation for prescription and activity outcomes for ISRS

Category 1 System/Legal	Category 2 Professional Judgement (PJ)	Category 3 Activity/ Outcomes	Category 4 Written Documentation
System 98 % Legal 2%	PJ 7%	Activity 86% Outcomes 14%	See Table 10.6

Category 1 showed that both audits are predominately assessing compliance with the safety programme prescribed by the audit. Only 2% of ISRS and 3% of CHASE required any compliance with any specified legal standard.

On the degree of professional judgement required the audits are quite different. The CHASE audit required judgements to be made as to whether arrangements are suitable, adequate or appropriate for 45% of the questions. ISRS only required professional judgement for 7% of the questions. The majority of both audits required procedures etc. to be in place to comply with the requirements of the management system but did not address the issue as to whether the procedure achieved the objective it was set up to achieve. CHASE required less written documentation than ISRS see Table 10.5 and Table 10.6.

Table 10.5 CHASE Documentation

LIST

Regulations, other statutory requirements or standards which apply to the machinery and plant in the workplace

Regulations, other statutory requirements and advisory publications which apply to the input energy sources used in the defined area

Statutory requirements or other standards applying to vehicle maintenance work

PLAN/PROCEDURE

Annual estimate of forthcoming health and safety expenditure

Written procedure for action in the event of a fire or explosion

Written procedure for reviewing the policy

POLICIES

Health and Safety Policy

Policy on standards of housekeeping

RECORDS

Maintenance activities recorded

Permanent record of the hazardous substance hazard & risk assessment

Records kept and analysed for:

Complaints of ill health? Employee's illnesses

Medical examination Results

Health Hazard incidents

health audit Results

REGISTER

a register of the location of all major fixtures and fittings

maintenance register for each vehicle

register kept of the maintenance and repair

requirements of tools and equipment?

register maintained of employees'

qualifications to drive specific vehicles

RULES

written rules, for carrying out detailed safety surveys on all machinery and plant in the workplace

written rules, to ensure that new or second-hand machinery or plant is safe

DESCRIPTION

written description of the nature and extent of the hazard(s) for a special case

Table 10.6 ISRS Documentation

WRITTEN DIRECTIVES

Task observation programme
Formal safety & health/loss control reviews
Task analysis & development of practices

FORMS

Accident/incident investigation
Annual management audit forms
Mobile & materials handling equipment inspection

Partial/spot task observations

Complete task observations

FILES/DOCUMENTATION

Planned general inspection reports
Programme audits/evaluations
High potential and major loss investigation

LISTS & INVENTORIES

Inspections required by governmental agencies, law & organisational requirements
All equipment, materials, structures and areas
Occupations divided into the tasks performed
Chemical substances

Mobile and materials handling equipment

Written aids for tours

MANUALS

S & H/loss control reference manual

MEMOS & LETTERS

Information about any high potential incident
major fires or property damage

Inf. on major injury/illness

Accident statistics for management

Follow-up action for major and high potential loss accidents to joint H & S committees

Off-the-job and safety sent to homes

Off-the-job safety inf. to management

WRITTEN OBJECTIVES

Task analysis & procedure for all critical tasks

PROCEDURES/PLANS

Remedial actions as recommended in the incident investigation report

Accident/incident investigation procedure

Emergency plan for all probable emergencies

Hazards reported by employees

To process requests from employees and to provide feedback to them about concerns

Joint S & H committee recommendations are received, considered and properly addressed

Problems identified through complete and spot task observations are completed

Safe disposal of hazardous waste

Disciplinary action for violation of established protective equipment standards

Correcting items identified during inspections

Handling refusal to work situations

POLICIES

General policy statement

Commendation for complying with rules

REPORTS

Status of incomplete remedial actions
Substandard conditions and practices observed during planned general inspections

Substandard hazardous conditions noticed by employees, H&S committees, or supervisors

Inspections & remedial actions confirmed

RECORDS

Considerations & decisions of accident/incident review meetings

Employee training tests recorded and filed

Critical task analysis and procedure

reviewed, completed or updated?

Instruction in the need for and use, cleaning, and maintenance of PPE

Issue of non-disposable PPE

Rule receipt,

1. Positive recognition for rule compliance

2. Disciplinary action for on-compliance

Retraining or skill practice occurs

Monitoring data of chemical, biological, and physical agents

Employee's exposure(s) to chemical, biological, or physical agents

Records of accident/incident investigation

reports

Critical parts/items inspections

Critical task analyses and work practices

Preventative maintenance dates and work done

Senior management induction training

Senior management initial S&H training

Senior management review S & H training

Supervisor middle management review S & H training

Audiometric test results

Managers' S&H/loss control performance

RULES

Written general safety and health rules

STANDARDS

Conducting group S&H/loss control meetings with all personnel

Planned personal contacts to be made with employees

PPE standards rules and/or procedures for appropriate jobs

S&H/loss control orientation/induction for management personnel?

Requiring management to give task instruction with each new or different task assigned

Management performance

ARCHIVES

Inactive investigation reports over 2 years old

10.10 Control outcome questions

It was very difficult to single out those questions which looked at control outcomes because there was not a distinct difference between these and control activity questions. Those questions which were considered initially to be about control outcomes were re-examined. In this assessment many of the questions could have been eliminated from the category because although they probed more deeply into control activity they were on reflection not about control outcomes.

The questions that had been put in the category had a number of characteristics:

- they often required professional judgement using words such as 'how effective';
- they often asked for information on percentage compliance;
- in ISRS they often asked how often a given activity had been carried out.

Inquiring 'how often' an activity is carried is considered by Dawson (1983) not to be a control outcome. However, asking 'how often' is a more probing question than just asking about whether an activity is done. The questions categorised as control outcomes therefore were considered to be more probing than the other questions but not necessarily about outcomes.

10.11 Audit model

The work discussed in this chapter explored different facets of audits and how they could be evaluated. At this stage it was considered appropriate to construct an audit model to draw together the different aspects of audits that it was practicable to consider in an evaluation. This is shown in Figure 10.1

Figure 10.1 Audit Model

AUDIT MODEL
<i>Focus</i> General for all hazards For specific hazards
<i>Content/Scope</i> All or one of the following management elements: Policy Organising Planning and Implementing Measuring Performance Reviewing Performance Auditing
<i>Measurement</i> Control Activity Control Outcomes Hazard Outcomes

The audit model highlights the different approaches to auditing. An audit might focus on the control of all hazards or a few specific hazards. Assessment of the management of the hazard could examine all of the management elements or just one. The performance measurement or the score achieved could concentrate on 'control activity' or could consider 'control outcomes' or 'hazard outcomes'. By using the audit model an organisation could decide what approach to take when it conducts an audit. For example an organisation could choose to examine the organising of one hazard by looking at control outcomes, i.e. all aspects of machinery safety by requiring proof that those persons with responsibilities have carried out their duties.

The evaluation of existing proprietary audit questions however cannot be as simple as the audit model. Questions do not fit neatly into the management elements for the reasons given in paragraph 10.3 and it is difficult to make a precise distinction between a control activity and a control outcome. Therefore audit questions need to be categorised with many more headings than those given in the model.

10.12 Conclusion

Audit questions measure control activity or outcomes by asking for:

- compliance with legal requirement
- fulfilment of an audit requirement
(all or nothing)
- some degree of achievement of an audit requirement
(scale or percentage)

- a prescribed activity to be carried within a certain time period
- verification of an audit requirement
- professional judgement

Although it is difficult to identify 'control outcome' questions it is practical to consider to what degree questions are prescriptive and probing. Therefore a prescription and probing index should be a feature of an audit classification system.

CHAPTER 11

Database Development

11.1 Introduction

For previous classifications, tables in a word processing package had been used to sort questions. This method became difficult for multi-tagging of question. Working with a large table was slow on the computer and only very limited sorting of the coded questions could be carried out. A switch was made to a database so that more information could be associated with each question and to allow better sorting of the questions. It would also be possible to carry out word searches.

11.2 The database

A Claris database called FileMaker Pro, version 2.1. was chosen on the advice of a respected software supplier. The database was run on a Macintosh computer but the same application is also available for PC computers. A database file was created for the audits ISRS, CHASE and QSA. The audit questions were imported from Microsoft Word files into each of the database files. The questions became the records in the files and fields were created for different categories.

11.3 Adaptation of category list

A decision was made to use a modified version of the multi-tagging category list given in Table 10.2. It was necessary to modify the list to facilitate word searching and to ensure that there was no repetition of categories in different sections of the list. The categories which are now in the database are collated under the following main headings:

- question character - clarity, prescription, probing and marginal utility
- health and safety organisation and functions
- people
- workplace
- work activities
- hazard identification and risk assessment
- risk control
- specific topics

The inclusion of various topics under these headings is discussed in the next paragraphs.

11.4 Question character

The following seven categories were originally proposed for question character:

- 0.1 Probing index HIGH/MODERATE/LOW
- 0.2 Prescription index HIGH/MODERATE/LOW
- 0.3 Marginal utility index GOOD/MODERATE/LOW
- 0.4 Score chasing/audit mismatch index GOOD/MODERATE/POOR
- 0.5 Clarity index GOOD/MODERATE/POOR
- 0.6 Relevance index HIGH/MODERATE/LIMITED APPLICATION
- 0.7 Multiple requirement index SINGLE/TWO/MULTIPLE

It was decided not to use numbers '0.4 Score Chasing'¹² and '0.6 Relevance'. These indices required careful examination of each question and were not suitable for word searching. Relevance had been tried out in an earlier categorisation and it had been found that it was difficult to assess a question on its relevance or importance. To use this category successfully it would be necessary to have a particular industry in mind and knowledge of its health and safety requirements. The categories that were used under question character were:

- clarity
- prescription
- probing
- marginal utility.

Clarity was divided into satisfactory, multiple question and unclear. The category was subjective but easy to use because all that was required was a decision to be made as to whether the question was understandable or not and if it asked two questions at the same time. For example the following questions were categorised as multiple questions:

" If this person is not based at the site, is there a separate 'local' policy statement confirming commitment issued under the signature of the local site manager?"

In the work area or the process selected by the auditor, have all of the employees covered by the assessment (s) been provided with information and training on the weight of each load and the heaviest side of any load whose centre of gravity is not positioned centrally". (ROSPA 1994)

¹²Score chasing meant that changes could be easily made to satisfy the question without the need to make any actual health and safety improvements.

The prescription category underwent a number of changes. Originally there were 6 sub-divisions (absolute, frequency/percentage, company objective, written, legal compliance, adequate/suitable etc.) but these were reduced to those given in Table 11.1.

Table 11.1 Prescription categories and key words

Prescription	Key Words
Standard Compliance	legal, legislation, legislative, standard
Professional Judgement	adequate, suitable, satisfactory, high, appropriate, sufficient, necessary, relevant, clearly, readily, applicable, safest, best
Written	written, in writing

'Probing' was initially divided into: documents/procedures, software, hardware, evidence plan control/actually in use or not, plan/works control satisfactory or not. This list was used to categorise questions in the QSA audit with some success but the categories were not all suitable for word searching. The headings were modified several times and finally became those listed in Table 11.2

Marginal utility was a category designed to describe how much had to be done to achieve a yes answer to a question. For example 'Is there an inventory of all substances used? To achieve a 'yes' answer substances offering trivial or no risk and used in very small quantities would still have to be included. Therefore by not been able to achieve the last part of the question credit could not given for achieving the majority of the requirement. An audit that contained a large number of these types of questions could be criticised for being to pedantic and requiring the

impossible. The category was entered as a field on the database and the key word 'all' was used to search for these questions. Rather than have a category on its own 'marginal utility' was included as one of the options in the probing index.

Table 11.2 Probing index and key words

Probing	Key Words
Arrangements/procedures	arrangement, procedure
Documents, policies, certificates	document, policy, certificate, manual, record, file, literature, books, form
Frequency	annual, yearly, monthly, daily
Percentage compliance	percent, percentage
all	all

11.5 Health and safety organisational functions

For corporate health and safety organisational functions there were originally the following 12 categories :

- 1.1 Preparation/implementation of health & safety policy/plans?
- 1.2 Monitoring and/or review of policy/plans?
- 1.3 Creation/maintenance of Information Systems?
- 1.4 Communication/consultation?
- 1.5 Health and safety committees?
- 1.6 Personal responsibilities?
- 1.7 Selection and/or training?
- 1.8 Personal health and safety performance review/feedback?
- 1.9 Hazard Management?
- 1.10 Activities that promote/demonstrate corporate/senior management commitment?
- 1.11 Activities that promote/demonstrate employee commitment?
- 1.12 Other organisational/functional issues not listed above?

It was found that there was repetition within the group. For instance the category 'hazard management' was covered in the section 'hazard management procedures'. 'Health and safety committees' was considered to be another form of 'communication consultation' and therefore the two categories were amalgamated. The word 'corporate' was deleted from the heading and the categories shown in Table 11.3 were included.

Table 11.3 Health and safety organisation and functions

Category	Key Words
1.1 policy/plans/objectives	1.1 policy, objective, plan
1.2 Communication, consultation	1.2 communication, consultation, committee, team, information, news, meeting
1.3 Responsibilities, duties	1.3 responsibility, responsibilities, performance, duty, job description, job specification, duties, signature, authority
1.4 Commitment, involvement, promotion	1.4 commitment, culture, motivation, leadership, promotion, awareness
1.5 Compliance	1.5 legal, legislative, legislation, standard, discipline, compliance
1.6 Auditing	1.6 audit, monitor, measure, evaluate, review, performance
1.7 Resources	1.7 resource, finance, budget, cost, funding

11.6 People

For people there was originally the following 14 categories:

- 2.1 Directors?
- 2.2 Managers?
- 2.3 Supervisors?
- 2.4 All employees/employees not specified?
- 2.5 Operatives?
- 2.6 New personnel an/or personnel with new responsibilities?
- 2.7 Young persons?
- 2.8 Health and safety specialists?
- 2.9 Competent/expert persons?
- 2.10 Health and safety representatives?
- 2.11 Contractors and/or contractors' personnel?
- 2.12 Persons other than employees?
- 2.13 The public (including visitors)?
- 2.14 Other persons/groups not listed above?

This list was considered to be far too large so a number of the categories were amalgamated. For instance 'directors' was joined with 'managers', 'persons other than employees' with 'the public'. The resulting categories are given in Table 11.4.

Table 11.4 People

Category	Key Words
2.1 Directors/managers	2.1 director, manager
2.2 Supervisors	2.2 supervisor, supervision
2.3 Employees/operatives	2.3 employee, operative, team
2.4 Contractors	2.4 contractors, non-employee
2.5 The public (including visitors)	2.5 public, visitors, community, consumer
2.6 Health and safety support (including medical, first-aid, fire)	2.6 assistance, co-ordinator, officer, advisor(or), first-aider, staff, marshal, physician, doctor, nurse, hygienist, professional
2.7 All other people	2.7 people, persons

11.7 Workplace

For the workplace there was originally the following ten categories:

- 3.1 Buildings and/or work areas
- 3.2 Fixed plant and/or machinery
- 3.3 Processes
- 3.4 Transport
- 3.5 Energy sources
- 3.6 Equipment/tools
- 3.7 Storage facilities
- 3.8 Materials
- 3.9 Substances
- 3.10 Other aspects of the workplace not listed above

This list was modified substantially because some of the categories such as 'materials and substances' were considered not to be about the workplace. Instead this category was put in the 'work activities' section. Table 11.5 lists the categories in this group. The eighth category 'posters and notice boards' was added at a later stage when the system was tried out on questions.

Table 11.5 Workplace

Category	Key Words
3.1 Access, egress	3.1 pedestrian, egress, walk, route, car park, sign
3.2 Fixed plant and/or machinery	3.2 plant, machinery, fitting
3.3 Transport	3.3 transport, vehicle
3.4 Toilets, washrooms	3.4 toilet, wash, shower, hygiene, shower, canteen
3.5 Storage facilities	3.5 storage, store
3.6 heating/lighting	3.6 heating, lighting
3.7 housekeeping	3.7 housekeeping, cleanliness, tidy
3.8 posters/notice boards	3.8 poster, bulletin board, notice board

11.8 Work activities

Work activities originally included the following:

- 4.1 Work activities/tasks (gen.)
- 4.2 Designing and/or planning
- 4.3 Construction and/or demolition
- 4.4 Installation and/or commissioning
- 4.5 Operation
- 4.6 Maintenance and/or repair'
- 4.7 Materials etc. handling
- 4.8 Other activities not listed above

From this list the category 'operation' was omitted because it was considered to be too vague. Additional categories of 'materials handling', 'hazardous substances' and 'sale of products and services' were included. The categories are shown in Table 11.6.

Table 11.6 Work activities

Category	Key Words
4.1 Work activities/ tasks	4.1 task, use
4.2 Designing and/or planning	4.2 design, engineer, planning
4.3 Construct/install/demolish	4.3 construct, install, demolish
4.4 Change	4.4 change, modify
4.5 Maintenance/repair/clean	4.5 maintenance, repair, clean
4.6 Materials etc. handling	4.6 handling, load, fork lift
4.7 Use of substances hazardous to health	4.7 substance, chemical, hazardous material
4.8 Sale of products and services	4.8 product, client

11.9 Hazard identification and risk assessment

The group on 'hazard management procedures' was replaced with a group called 'hazard identification and risk assessment'. The following were the original categories in the group:

- 5.1 Incident investigation?
- 5.2 Injury accident investigation?
- 5.3 Exposure measurement and/or analysis?
- 5.4 Workplace (hardware) inspections?
- 5.5 Workplace (behavioural) inspections?
- 5.6 Workplace inspections (general)?
- 5.7 Hazard identification procedures?
- 5.8 Risk assessment/decision procedures?
- 5.9 Implementation of controls?
- 5.10 Monitoring and/or review of controls?
- 5.11 Other hazard management procedures not listed above?

Some of the categories listed were combined i.e. it was convenient for word searching to group together all questions on accident investigation whether they involved injuries or not. The category on implementation of controls was removed and a new category for inventories was included. The categories are shown in Table 11.7.

Table 11.7 Hazard identification and risk assessment

Category	Key Words
5.1 Incident/accident investigation	5.1 investigate, report, accident, damage, near-miss, injury, illness
5.2 Measure and/or analysis	5.2 exposure, measurement, analysis
5.3 Workplace inspections	5.3 inspections, tours, surveys
5.4 Inventories	5.4 inventory, list
5.5 Risk assessment techniques	5.5 risk assessment, assessment, hazard

11.10 Risk control

The hazard control measures group was changed to risk control. The original group contained the following categories:

- 7.1 Hazard elimination or reduction
- 7.2 Physical barriers and/or enclosure
- 7.3 Ergonomic design
- 7.4 Safe systems of work
- 7.5 Permit-to-work procedures
- 7.6 Training
- 7.7 Instruction and/or supervision
- 7.8 Personal protective equipment
- 7.9 Emergency procedures
- 7.10 Emergency equipment
- 7.11 Other hazard controls not listed above

This was modified in a number of ways. For instance 'ergonomic design' was removed, 'physical barriers and/or enclosure' became 'engineering controls', 'emergency procedures' became 'amelioration'. Facilities was included to cover the provision of showers etc. But in retrospect this should not of been done as there is an overlap with category '3.4 Toilets, washrooms' in the workplace section. The final list of categories is given in Table 11.8.

Table 11.8 Risk control

Category	Key Words
6.1 Risk control implementation	6.1 risk control, action, implementation
6.2 Elimination and substitution	6.2 elimination, substitution
6.3 Engineering controls	6.3 guard, enclosure, ventilation, engineer
6.4 Facilities (e.g. showers)	6.4 room, wash, shower
6.5 Special equipment	6.5 detector, extinguisher, alarm, label, sign
6.6 Safe systems of work	6.6 safe system of work, rule, correct use
6.7 Permits to work	6.7 permit
6.8 Selection and training	6.8 selection, train, induction, interview, placement, qualification, course
6.9 PPE	6.9 PPE, protective equipment, clothing
6.10 Health surveillance	6.10 health surveillance, biological, medical, audiometry, audiometric, lung-function
6.11 Amelioration	6.11 emergency, first-aid, fire, evacuation, escape, danger, treatment

11.11 Specific topics

The hazard and statutory requirement groups listed were replaced with a group called specific topics. This included hazards but it also enabled other topics to be included such as named legislation from the

statutory requirement group. The categories listed in Table 11.9. replaced the following:

- 6.1 Hazards (not specified)
- 6.2 Slips/falls
- 6.3 Struck or crushed by ..
- 6.4 Contact with ..
- 6.5 Electricity
- 6.6 High pressure fluids
- 6.7 Fire and/or explosion
- 6.8 Substances hazardous to health
- 6.9 Asphyxiation
- 6.10 Noise and/or vibration
- 6.11 Working conditions that may promote WRULDs
- 6.12 Inadequate thermal environment
- 6.13 Other hazards not listed above

- 8.1 Health and Safety at Work Act 1974
- 8.2 Management of Health and Safety at Work Regulations 1992
- 8.3 Industry-specific acts/regulations?
- 8.4 Hazard-specific acts/ regulations?
- 8.5 Control measure-specific acts/ regulations?
- 8.6 Reporting/notification acts/ regulations?
- 8.7 General reference to legal requirements?
- 8.8 Other acts/regulations not identified/ characterised above?

Table 11.9 Specific topics

Category	Key Words
7.1 Energy	7.1 energy, electricity, electrical, pressure, gas, oil, compressed
7.2 Confined spaces	7.2 confined
7.3 Noise and vibration	7.3 noise, vibration
7.4 Visual display Units	7.4 visual display, VDU
7.5 Radiation	7.5 radiation
7.6 Off-the-job safety	7.6 off-the-job, health education
7.7 Environmental Management	7.7 environment, pollution, waste, disposal, by-product
7.9 Tools and equipment	7.8 tools, portable equipment, electrical equipment

11.12 Setting up the database

Two layouts one for data entry and one for results were set up on the database. This involved defining fields and positioning them on the layouts. An example of a layout is shown in Figure 11.1.

Figure 11.1

Section of the word count database layout

Question No. _____

Question Text _____

HS Organisation and functions

- ☐ 1.1 policy/plans/objectives
- ☐ 1.2 communication/consultation
- ☐ 1.3 responsibilities/duties
- ☐ 1.4 Commitment/involvement/promotion
- ☐ 1.5 compliance
- ☐ 1.6 auditing
- ☐ 1.7 resources
- ☐ 1.8 other

1.1 policy, plan, objective
1.2 communication, consultation,
committee, information, =news,
meeting
1.3 responsibility,
responsibilities, performance, job
description, job specification,
duties, signature, authority
1.4 commitment,
culture, motivation, leadership,
promotion, awareness
1.5 legal, legislation, legislative
standard, discipline, compliance
1.6 audit, monitor, measure,
evaluate, review, performance
1.7 resource, finance, budget, cost,
funding

To create this layout it was necessary to create 10 fields as follows:

- a number field for question number
- a text field for question text
- 8 text fields with predefined value lists for the 'HS organisation and function' categories

The key words were entered as text on the layout, where a word is prefixed with an equal sign denotes that it is necessary to search for exact matches only. An alternative to setting up 8 separate category fields is to set up one field containing 8 options. This was done in an earlier version of the word count layout but it was found that it was impossible to create a summary field for each of the options. This was necessary so that the results were calculated automatically. The 'other' box represents all the questions which did not fit into any of the categories in the group. It was important to have this field for carry out searches to locate unclassified questions.

The fields entered on the database are listed in Appendix 3. The word count layout used for the classification of questions is shown in Figure 11.2. The question used in this example is from the fifth edition of ISRS (ILCI 1988).

Figure 11.2 Example of Question Evaluation

- 1.1 Does the organisation at the corporate or local level have a general policy statement reflecting management's commitment to safety and health/loss control?

Prescription

- ☐ Compliance with standard
☐ professional judgement
☐ written
☒ other

legal, legislation, legislative, standard
adequate, suitable, satisfactory, high,
appropriate, sufficient, necessary, relevant,
clearly, readily, applicable, safest, best
written, writing

Probing

- ☐ arrangements/procedures
☒ documents, policies, certificates
☐ frequency
☐ percentage compliance
☐ all
☐ other

arrangement, procedure
document, policy, certificate, manual,
record, file, literature, books, form
annual, month, monthly, daily
percent, percentage
all

HS Organisation and functions

- ☒ 1.1 policy/plans/objectives
☐ 1.2 communication/consultation
☐ 1.3 responsibilities/duties
☒ 1.4 Commitment/involvement/promotion
☐ 1.5 compliance
☐ 1.6 auditing
☐ 1.7 resources
☐ 1.8 other

1.1 policy, plan, objective
1.2 communication, consultation,
committee, information, =news,
meeting, team
1.3 responsibility, responsibilities,
performance, job description, job
specification, duties, signature, authority
1.4 commitment, culture, motivation,
leadership, promotion, awareness
1.5 legal, legislation, legislative
standard, discipline, compliance
1.6 audit, monitor, measure, evaluate,
review, performance
1.7 resource, finance, budget, cost,
funding

People

- ☒ 2.1 Directors/managers?
☐ 2.2 Supervisors?
☐ 2.3 Employees/operatives?
☐ 2.4 Contractors?
☐ 2.5 The public (incl. visitors)
☐ 2.6 H & S support (incl. medical, first-aid, fire, reps)?
☐ 2.7 All other people
☐ 2.8 Other

2.1 director, manager
2.2 supervisor, supervision
2.3 employees, operative, team
2.4 contractors
2.5 public, visitors, community
2.6 assistance, coordinator, officer,
adviser, advisor, first-aider, first aider,
staff, marshall, physician, doctor, nurse,
hygienist, professional
2.7 people, persons

Workplace 1

- ☐ 3.1 access, egress
☐ 3.2 Fixed plant and/or machinery?
☐ 3.3 Transport?
☐ 3.4 toilets, washrooms?
☐ 3.5 Storage facilities?
☐ 3.6 heating/lighting
☐ 3.7 housekeeping
☐ 3.8 posters, notice boards
☒ 3.9 Other

3.1 pedestrian, egress, =sign, route
3.2 plant, machinery, fitting, process
equipment, fixture
3.3 transport, vehicles
3.4 toilet, wash, washroom, shower,
canteen
3.5 storage
3.6 heating, lighting
3.7 housekeeping, cleanliness
3.8 poster, notice board, bulletin board

Work activities

- ☐ 4.1 Work activities/tasks (gen)
- ☐ 4.2 Designing and/or planning?
- ☐ 4.3 Construct, install, demolish?
- ☐ 4.4 change
- ☐ 4.5 Maintenance, repair, cleaning?
- ☐ 4.6 Materials etc. handling?
- ☐ 4.7 Use of substances hazardous to health?
- ☐ 4.8 Supply of products and services
- ☒ 4.9 Other

Hazard ID 1

- ☐ 5.1 incident/accident investigation?
- ☐ 5.2 Measurement and/or analysis?
- ☐ 5.3 Workplace inspections?
- ☐ 5.4 Inventories?
- ☐ 5.5 Risk Assessment techniques
- ☒ 5.6 Other

- 4.1 task*,use
- 4.2 design*, engineer, planning
- 4.3 construct, install, demolish,
- 4.4 change, modify
- 4.5 maintenance*, cleaning, repair
- 4.6 handling, fork lift, load
- 4.7 substance, chemical, hazardous material
- 4.8 = product, client

- 5.1 investigation, investigate, reported, reporting, accident, damage*, near-miss, injury, injuries, illness
- 5.2 exposure, measurement, analysis
- 5.3 inspection, tours, surveys
- 5.4 inventory, list*
- 5.5 risk assessment, assessment, hazard*

Risk Control

- ☐ 6.1 Risk control implementation
- ☐ 6.2 Elimination and Substitution
- ☐ 6.3 Engineering Controls
- ☐ 6.4 Facilities (e.g.showers)
- ☐ 6.5 Special Equipment
- ☐ 6.6 Safe systems of work (incl. information, instruction)
- ☐ 6.7 Permits to work
- ☐ 6.8 Selection and training
- ☐ 6.9 PPE
- ☐ 6.10 Health surveillance
- ☐ 6.11 Amelioration
- ☒ 6.12 other

- 6.1 risk control, action*, implementation
- 6.2 elimination, substitution
- 6.3 guard, enclosure, ventilation, engineer
- 6.4 room, wash, shower,
- 6.5 detector, extinguisher, alarm,sign,label
- 6.6 safe system of work, rules,correct use
- 6.7 permit
- 6.8 selection, train, induction, interview, placement, qualification, course
- 6.9 PPE, protective equipment, clothing
- 6.10 health surveillance, biological, medical, audiometry, audiometric, lung function
- 6.11 emergency, first-aid, first aid, fire, evacuation, escape, danger,treatment

Specific Topics 1

- ☐ 7.1 Energy ?
- ☐ 7.2 Confined spaces
- ☐ 7.3 Noise and vibration
- ☐ 7.4 Visual Display Units
- ☐ 7.5 Radiation
- ☐ 7.6 Off-the-job safety
- ☐ 7.7 Environmental Management
- ☐ 7.8 Tools and equipment
- ☒ 7.9 Other

- 7.1 energy, electricity, electrical, pressure, compressed, gas, oil
- 7.2 confined
- 7.3 noise, vibration
- 7.4 VDU, visual display
- 7.5 Radiation
- 7.6 Off-the-job safety, health education
- 7.7 environment, pollution waste, disposal, by-product
- 7.8 Tools, portable equipment, electrical equipment

11.13 Importing questions into the database

Files were created for each of the proprietary audits ISRS, CHASE and QSA. Having created the first file the other two were created using the 'make clone command' under 'save as'. The questions for each of the audits were then imported into the 'question text' field in their respective files. This operation was very quick (the import took about a minute) but the records normally required some sorting out due, for example, to blank records being created for spaces left between questions. For a perfect import questions should be typed in rows in a two column table, one column for question number, one column for the question text and any other supporting text. No spaces should be left between rows in the table. Other information can also be entered such as question scores provided a field has been created to put them in.

11.14 Using the database

For each audit file a series of word searches was carried out. The words searched for are given at the side of each field as shown in Figure 11.1. For example for the category 'compliance with standard' a search was carried in the 'Word Count' layout as follows:

1. select find under 'SELECT' in the menu
2. ensure cursor is in the question text field
3. enter the first search word 'leg' (this will find legal, legislative and legislation)
4. under 'EDIT' in the menu click on 'NEW REQUEST'
5. in the question field box type in the second search word 'standard'

6. press return or click on the 'FIND' box
7. records containing words beginning with 'leg' and 'standard' will be found
8. click the 'compliance with standard' check box
9. under 'EDIT' in the menu click on replace
10. respond 'yes' to replace which will tag all the found records with 'compliance with standard'

Sometimes it is necessary to limit a word search to an exact match of the word. This can be done by entering a symbol (i.e. =) before the word in the search. For example this was necessary for the word 'design' because otherwise the search would find questions containing the word designated. Searches can also be carried out with more than one word such as 'protective equipment' and if necessary the search can be limited to only finding those questions which contained these words in the same order.

Having completed a word searches all the questions that have not been classified can be located by carrying out the find procedure on all of the 'other' boxes i.e. simply click on all the other boxes and press find. Those questions that had not been placed in the 'other' category for all of the sections where those questions that had not been tagged. Initially the number of questions unclassified by word searching was substantial. Approximately 200 in the case of QSA, 100 in the case of ISRS and 50 in the case of CHASE. This was partly to do with how the questions had been entered in the database. It is advisable when entering questions to include any supporting text given such as an introductory paragraph so each question stands alone. This does not

affect the results because any code can only be assigned to a question once regardless of how many key words of interest are found in the question. Supporting text had been entered for QSA as a separate field but only the question text field was used for word searching in this instance. This was because supporting text fields had not been included in the ISRS and CHASE files and when carrying out the word searches it was desirable to follow the same procedure for all three audits. It is estimated that had the supporting text field been searched for QSA then about half of the 200 questions not categorised would have been tagged.

Those questions which were not sorted by word searching were categorised manually. This involved sometimes checking on supporting text that goes with the question before deciding on which of categories applied to the question. With the question displayed at the top of the screen it was easy to scan through the various categories to decide which applied and eliminate the question from the 'other box'. There was less of a problem with subjectivity than with the earlier print-based categorisation discussed in Chapter 7 because it was possible to multi-tag the questions. As a result of the manual categorisation some key words were added to the database and a completely new category for posters and notice boards was included.

11.14 Conclusion

The database developed is an efficient method of categorising audit questions and is much quicker than categorising all of the questions manually. There are 70 categories in the database layout, word searching for all these categories takes about 2 hours. Those questions

which are not classified by word searching can be easily located for manual categorisation.

CHAPTER 12

Database Results

12.1 Results

The CHASE database categorisation file is given on a Macintosh computer disk and a PC disk as Appendix 4. To view this file requires a Macintosh or PC computer loaded with the application FileMaker Pro. A hard copy of the results for CHASE are given in Appendix 5, for ISRS in Appendix 6 and for QSA in Appendix 7.

12.2 Comparison of the audits

The number of questions in each category for all three audits were converted to percentages. As percentages it was easier to compare the three audits that had different number of questions. The number of questions on the database for ISRS, CHASE and QSA were 576, 369 and 672 respectively. These figures represent records in the database which may be less than the actual number of questions because in some cases a series of questions were entered as one record. For example a question stating is an activity carried out daily, weekly, monthly or annually would be entered as one record rather than four.

The percentage number of questions in each category for the audits is shown in Table 12.1. The same table in terms of numbers of questions

is given in given in Table 12.2. The weighting of the audits on various topics is discussed in sections 12.2 - 12.10.

Table 12.1 Content comparison of 3 proprietary audits in percentage number of questions

	No. of questions in the audit as a percentage of the total		
	ISRS	CHASE	QSA
Prescription			
Standard Compliance	12	4.3	4.2
Professional Judgement	17	46	5.7
Written	7.8	2.4	4.8
Probing			
Arrangements/procedures	13	29	18
Documents, policies, certificates	6.2	14	16
Frequency	9.0	0.8	6.3
Percentage compliance	8.9	0.0	3.4
all	14	20	10
H & S Organisation and functions			
1.1 policy/plans/objectives	13	14	15
1.2 Communication/consultation	12	8.9	7.4
1.3 Responsibilities & duties	5.7	12	7.0
1.4 Commitment/involvement/promotion	3.8	0.8	3.9
1.5 Compliance	12	4.3	4.5
1.6 Auditing	24	10	18
1.7 Resources	2.4	4.1	3.4
Total	55	44	47
People			
2.1 Directors/managers	20	1.6	6.0
2.2 Supervisors	4.9	1.6	4.3
2.3 Employees/operatives	17	12	18
2.4 Contractors	1.4	1.1	2.5
2.5 The public (including visitors)	0.7	0.5	1.2
2.6 Health and safety support	1.6	2.2	3.9
2.7 All other people	0.3	0.0	3.0
Total	42	17	29
Workplace			
3.1 Access, egress	0.2	1.9	0.0
3.2 Fixed plant/machinery/fittings	1.0	5.1	0.9
3.3 Transport	0.2	3.5	0.0
3.4 Hygiene, canteens and rest rooms	0.0	0.5	0.0
3.5 Storage facilities	1.4	3.0	0.1
3.6 Heating/lighting	0.0	0.0	0.0
3.7 Housekeeping	1.0	0.3	0.0
3.8 Posters/notice boards	2.2	0.0	0.6
Total	5.5	13	1.6

No. of questions in the audit as a percentage of the total

	ISRS	CHASE	QSA
Work activities			
4.1 Work activities/ tasks in general	10	3.2	2.1
4.2 Design/plan/commission	1.6	0.0	0.3
4.3 Construct/install/demolish	0.5	0.3	0.6
4.4 Change	2.6	6.0	0.9
4.5 Maintenance/repair/clean	3.0	7.9	0.7
4.6 Materials handling	0.7	0.3	1.6
4.7 Use of substances hazardous to health	5.0	5.1	3.4
4.8 Sale of products and services	0.2	0.0	0.6
Total	24	22	10
Hazard Identification/Risk Assessment			
5.1 Incident/accident investigation	10	6.8	10
5.2 Measurement and/or analysis	3.3	10	4.9
5.3 Workplace inspections	6.9	8.7	4.8
5.4 Inventories	1.2	1.1	1.2
5.5 Risk assessment	0.2	1.6	7.3
Total	19	27	26
Risk Control			
6.1 General risk control implementation	0.9	1.3	3.4
6.2 Elimination and substitution	0.0	0.3	0.1
6.3 Engineering controls	0.5	4.9	1.2
6.4 Facilities e.g. showers	0.0	0.3	0.0
6.5 Special equipment	1.4	1.3	0.3
6.6 Safe systems of work	6.1	4.9	4.8
6.7 Permits to work	0.7	1.1	0.1
6.8 Selection and training	11	10	11
6.9 PPE	4.7	4.3	0.7
6.10 Health surveillance	1.0	2.2	2.8
6.11 Amelioration (fire, first-aid etc.)	12	6.8	3.6
Total	32	34	25
Specific Topics			
7.1 Energy	0.7	7.0	1.3
7.2 Confined spaces	0.3	0.0	0.0
7.3 Noise and vibration	0.2	0.3	0.0
7.4 Visual display units	0.0	0.0	1.0
7.5 Radiation	0.2	0.3	0.0
7.6 Off-the-job safety	3.3	0.0	0.9
7.7 Environmental Management	1.7	0.8	0.9
7.8 Tools and equipment	0.0	3.5	0.0
Total	5.2	11	4.2

Table 12.2 Content comparison of 3 proprietary audits in number of questions

	<i>No. of questions in the audit</i>		
	ISRS	CHASE	QSA
Prescription			
Standard Compliance	68	16	28
Professional Judgement	99	169	38
Written	45	9	32
Total	163	182	57
Probing			
Arrangements/procedures	73	106	122
Documents, policies, certificates	36	50	109
Frequency	52	3	42
Percentage compliance	51	0	23
all	81	73	67
Total	249	201	290
H & S Organisation and functions			
1.1 policy/plans/objectives	75	52	98
1.2 Communication/consultation	72	33	50
1.3 Responsibilities & duties	33	45	47
1.4 Commitment/involvement/promotion	22	3	26
1.5 Compliance	68	16	30
1.6 Auditing	137	36	121
1.7 Resources	14	15	23
Total	314	164	316
People			
2.1 Directors/managers	118	6	40
2.2 Supervisors	28	6	29
2.3 Employees/operatives	99	43	123
2.4 Contractors	8	4	17
2.5 The public (including visitors)	4	2	8
2.6 Health and safety support	9	8	26
2.7 All other people	2	0	20
Total	241	61	198
Workplace			
3.1 Access, egress	1	7	0
3.2 Fixed plant/machinery/fittings	6	19	6
3.3 Transport	1	13	0
3.4 Hygiene, canteens and rest rooms	0	2	0
3.5 Storage facilities	8	11	1
3.6 Heating/lighting	0	0	0
3.7 Housekeeping	6	1	0
3.8 Posters/notice boards	13	0	4
Total	32	49	11

	ISRS	CHASE	QSA
Work Activities			
4.1 Work activities/ tasks in general	60	12	14
4.2 Design/plan/commission	9	0	2
4.3 Construct/install/demolish	3	1	4
4.4 Change	15	22	6
4.5 Maintenance/repair/clean	17	28	5
4.6 Materials handling	4	1	11
4.7 Use of substances hazardous to health	29	19	23
4.8 Sale of products and services	1	0	4
Total	127	81	64
Hazard Identification/Risk Assessment			
5.1 Incident/accident investigation and reporting	55	25	64
5.2 Measurement and/or analysis	19	37	33
5.3 Workplace inspections	40	32	32
5.4 Inventories	7	4	8
5.5 Risk assessment	1	6	49
Total	111	99	173
Risk Control			
6.1 Risk control implementation	5	5	23
6.2 Elimination and substitution	0	1	1
6.3 Engineering controls	3	18	8
6.4 Facilities e.g. showers	0	1	0
6.5 Special equipment	8	5	2
6.6 Safe systems of work	35	18	32
6.7 Permits to work	4	4	1
6.8 Selection and training	66	38	76
6.9 PPE	27	16	5
6.10 Health surveillance	6	8	19
6.11 Amelioration (fire, first-aid etc.)	68	25	24
Total	187	124	168
Specific Topics			
7.1 Energy	4	26	9
7.2 Confined spaces	2	0	0
7.3 Noise and vibration	1	1	0
7.4 Visual display units	0	0	7
7.5 Radiation	1	1	0
7.6 Off-the-job safety	19	0	6
7.7 Environmental Management	10	3	6
7.8 Tools and equipment	0	13	0
Total	30	40	28

12.3 Prescription

ISRS is the most prescriptive requiring the most compliance with standards and written documentation. CHASE is the least prescriptive, emphasis is put on the judgement of the auditor to decide if arrangements etc. are adequate. CHASE requires very little written documentation. QSA requires less written documentation than ISRS but still a substantial amount in comparison to CHASE. It has a third of the number of questions on standard compliance than ISRS and very few questions requiring professional judgement.

12.4 Probing

The purpose of this index was to determine how much the questions probed into whether controls were successful. The categories which were included showed the prominence given to the use of procedures, documentation and compliance testing by requiring the auditor to state the percent of adherence to a particular requirement or how often it was carried out. QSA was shown to put the greatest emphasis on procedures and documentation. CHASE also had a high proportion of questions in the procedure and arrangements category. In CHASE the terminology used was arrangement rather than procedure. CHASE did not make much use of frequency or percentage compliance testing but this type of question features in both QSA and ISRS.

12.5 Health and Safety Organisation and Functions

There was extensive coverage of most of the items in this group by all of the audits. For ISRS this represented 55% of the audit, for CHASE 44% and for QSA 47%. CHASE had only a few questions on 'Commitment, involvement and promotion' and fewer questions on auditing than the other two audits.

12.6 People

In this group there was a striking difference between the high number of questions involving management in ISRS compared with either of the other two audits. Both CHASE and ISRS covered the role of management to a much lesser degree. Using the database it was possible to find all the management questions in each audit to assess what topics they covered see Table 12.2. The individual questions in some of the categories were also examined to discover what approach was taken.

Table 12.3 Analysis of management questions

<u>Management Questions</u>	<u>ISRS</u>	<u>CHASE</u>	<u>QSA</u>
Policy/plans/objectives	22	1	4
Communication/consultation	25	2	3
Responsibilities & duties	12	1	2
Commitment/involvement/ promotion	9	2	2
Compliance	16	-	2
Auditing	48	1	3
Resources	2	-	1
Work activities/tasks (general)	19	-	-
Designing and/or planning	2	-	-
Incident/Accident Investigation	13	-	-
Measurement/analysis	-	-	6
Workplace Inspections	17	-	2
Inventories	1	-	-
Risk Control Implementation	-	-	4
Safe systems of work	8	-	-
Permits to work	1	-	-
Selection and training	18	-	-
PPE	8	-	-
Amelioration	5	-	1
Off-the-job the safety	9	-	2
Environmental Management	3	-	-

ISRS required management to be trained in a number of the safety programme elements such as task analysis, it also required management to take part in meetings and carry out workplace inspections and to be made aware of safety results and issues. QSA required some of this involvement but to a much lesser extent. CHASE covered some issues that were relevant to management under questions which applied to all employees at all levels, there was 10 of these questions in total. Management specifically were expected to sign the Health and Safety Policy, take part in and communicate with the

Health and Safety Committee and to support Safety Representatives. The auditor is also expected to judge whether management was perceived to be committed to Health and Safety.

For the rest of the categories in the people group all the audits covered supervision, contractors, the public, health and safety support and employees in general. The newest audit, QSA devoted more questions to contractors, the public, and health and safety support. This reflects the emphasis given to these groups in recent legislation namely the Management of Health and Safety Regulations 1992 (Great Britain). In Health and Safety support ISRS and CHASE looked mainly at medical staff. CHASE appeared to have no questions relating to a safety advisor, ISRS had two questions: one to do with how much time was devoted to health and safety and one to do with whether the adviser signed engineering designs. QSA covered in detail recruitment and training of competent persons to carry out assessments and to implement control measures.

12.7 Workplace

The percentage of questions in this section for all the audits was low. Chase had the most at 13%, ISRS had 6% and QSA only 2%. CHASE has specific questions about machinery guarding, storage, toilets and transport whereas the other audits concentrated questions on the workplace to inspections which is included in the hazard identification group. However, in conducting an ISRS audit there has always been a requirement to carry out a survey of conditions in the workplace. Topics included in the physical conditions survey include access,

egress, lighting, machinery guarding and storage. A company could not obtain any star rating unless a satisfactory result which was usually a score of 60% was achieved in the physical conditions survey. Therefore the absence of questions about the workplace is justified in the case of ISRS because the topics are covered in the physical conditions survey. This is not the case in QSA. There is no other requirement concerning workplace conditions other than the eleven questions identified within this group.

12.8 Work Activities

ISRS stood out from the other two audits because of the emphasis given to task analysis which is not present in the other audits. The use of task analysis as described in ISRS is a form of risk assessment. There is a requirement for identifying critical tasks from a health and safety point of view. These critical tasks then have to be controlled. The nearest CHASE gets to this approach is in the following question:

"Are there written safe systems of work for all existing tasks involving significant risks to health and safety?." (CHASE 1989)

No questions were identified in this section for identifying tasks involving significant risks to health. Therefore in CHASE there was no lead into this important question. Most of the CHASE questions in this category were considered difficult to answer because they contained the prefix all. For example the question:

"Are there appropriate arrangements for co-ordinating ALL tasks carried out by defined personnel?" (CHASE 1989)

is very vague, it contains the term all tasks and does not give any indication as to who are considered to be defined personnel. In QSA the majority of questions in the category were concerned with training particularly for the task of taking part in the health and safety committee. There was a useful question on supervision for critical tasks. Looking at the rest of the group the coverage of the topics was similar in all three audits. ISRS had more questions to do with design, CHASE had the most on change and maintenance. None of the audits covered consumer or client safety in any detail.

12.9 Hazard Identification

All three audits had a relatively large number (7-10% of audit) of questions covering the reporting and investigation of accidents, illness and dangerous occurrences. QSA and CHASE had more questions on 'measurement and analysis'. Most of these involved the monitoring of different health and safety arrangements or personal performance, there were some questions on monitoring exposure to noise and hazardous chemicals. ISRS had less questions, this was perhaps because there was more emphasis on auditing. There is some overlap between this category of 'measurement and analysis' and the 'auditing' category. There was substantially more questions on risk assessment in QSA than in either CHASE or ISRS.

12.10 Risk Control

All the audits were strong on safe systems of work and selection and training. CHASE had the most number of questions on engineering

controls and to some degree covered all the other topics except elimination and substitution' in the group. QSA had the most number of questions on the general implementation of risk controls and on health surveillance but had relatively few questions on amelioration (emergency planning, first-aid, fire).

12.11 Specific Topics

A limited number of special topics were included in the categorisation. CHASE has quite a few questions on the management of energy so this was included as a specific topic. QSA has a section on Visual Display Units so this was included. Off-the-job safety was included for some ISRS questions

12.12 Content in general

Having examined the differences and similarities between the audits in the various sections in to which the questions were grouped attention was turned to establishing a better overall picture of the audits. This was done by sorting the topics and putting those with the greatest number of questions at the top of a list. For example Table 12.3 was produced that compares topics covered by the three audits. In Chapter 8 a ranking method was used that involved grouping word count results. The same techniques was used on the database results to produce Tables 12.4 and 12.5. Table 12.4 shows the similarities between all three audits as shaded areas. Table 12.5 shows the differences between the audits as unshaded areas.

Table 12.4 ISRS, CHASE and QSA sorted by topic

Similarities at the top and bottom of the table are shaded.

ISRS	CHASE	QSA
auditing	policy/plans/objectives	auditing
directors/managers	responsibilities & duties	employees/operatives
employees/operatives	employees/operatives	policy/plans/objectives
policy/plans/objectives	auditing	selection and training
communication/consultation	selection and training	incident investigation
compliance	measurement and/or analysis	communication/consultation
amelioration	communication/consultation	risk assessment
selection and training	workplace inspections	responsibilities & duties
work activities/ tasks	maintenance/repair/clean	directors/managers
incident investigation	energy	measurement and/or analysis
workplace inspections	incident investigation	workplace inspections
safe systems of work	amelioration	safe systems of work
responsibilities & duties	change	compliance
use of hazardous substances	plant/machinery/fittings	supervisors
supervisors	use of hazardous substances	commit/involve/promote
PPE	engineering controls	health and safety support
commit/involve/promote	safe systems of work	amelioration
measurement and/or analysis	compliance	resources
off-the-job safety	PPE	use of hazardous substances
maintenance/repair/clean	resources	risk control implementation
change	transport	all other people
resources	tools and equipment	health surveillance
posters/notice boards	work activities/ tasks	work activities/ tasks
environmental management	storage facilities	contractors
health and safety support	health and safety support	materials handling
design/plan/commission	health surveillance	energy
contractors	access, egress	the public (including visitors)
storage facilities	directors/managers	inventories
special equipment	supervisors	engineering controls
inventories	risk assessment	visual display units
plant/machinery/fittings	risk control implementation	plant/machinery/fittings
housekeeping	special equipment	change
health surveillance	contractors	off-the-job safety
risk control implementation	inventories	environmental management
the public (including visitors)	permits to work	PPE
materials handling	commit/involve/promote	maintenance/repair/clean
permits to work	environmental management	posters/notice boards
energy	the public (including visitors)	construct/install/demolish
construct/install/demolish	hygiene, canteens & rest rooms	sale of products and services
engineering controls	housekeeping	design/plan/commission
all other people	materials handling	special equipment
confined spaces	construct/install/demolish	storage facilities
access, egress	noise and vibration	permits to work
transport	radiation	elimination and substitution
sale of products and services	elimination and substitution	housekeeping
risk assessment	facilities e.g. showers	confined spaces
noise and vibration	off-the-job safety	access, egress
radiation	posters/notice boards	transport
hygiene, canteens & rest rooms	design/plan/commission	noise and vibration
heating/lighting	all other people	radiation
elimination and substitution	confined spaces	hygiene, canteens & rest rooms
facilities e.g. showers	sale of products and services	heating/lighting
visual display units	heating/lighting	facilities e.g. showers
tools and equipment	visual display units	tools and equipment

Table 12.5 Similarities between the audits

Ranking of the audit questions

- 1 = >10 % of the audit questions
- 2 = 10 - 6.5 % of the audit questions
- 3 = 6.4 - 4.5 % of the audit questions
- 4 = 4.4 - 2.5 % of the audit questions
- 5 = 2.4 - 1.5 % of the audit questions
- 6 = 1.4 - 1 % of the audit questions
- 7 = < 1 % of the audit questions
- 8 = 0 % of the audit questions

Similarities are shaded

	ISRS	CHASE	QSA
1.1 policy/plans/objectives	1	1	1
1.2 Communication/consultation	1	2	2
1.3 Responsibilities & duties	3	1	2
1.4 Commitment/involvement/promotion	4	7	4
1.5 Compliance	1	4	4
1.6 Auditing	1	2	1
1.7 Resources	5	4	4
2.1 Directors/managers	1	5	3
2.2 Supervisors	3	5	4
2.3 Employees/operatives	1	1	1
2.4 Contractors	6	6	5
2.5 The public (including visitors)	7	7	6
2.6 Health and safety support	5	5	4
2.7 All other people	7	8	4
3.1 Access, egress	7	5	8
3.2 Fixed plant/machinery/fittings	6	3	7
3.3 Transport	7	4	8
3.4 Hygiene, canteens and rest rooms	8	7	8
3.5 Storage facilities	6	4	7
3.6 Heating/lighting	8	8	8
3.7 Housekeeping	6	7	8
3.8 Posters/notice boards	5	8	7
4.1 Work activities/ tasks in general	2	4	5
4.2 Design/plan/commission	5	8	7
4.3 Construct/install/demolish	7	7	7
4.4 Change	4	3	7
4.5 Maintenance/repair/clean	4	2	7
4.6 Materials handling	7	7	5
4.7 Use of substances hazardous to health	3	3	4
4.8 Sale of products and services	7	8	7
5.1 Incident/accident investigation	2	2	2
5.2 Measurement and/or analysis	4	2	3
5.3 Workplace inspections	2	2	3
5.4 Inventories	6	6	6
5.5 Risk assessment	7	5	2
6.1 General risk control implementation	7	6	4
6.10 Health surveillance	6	5	4
6.11 Amelioration (fire, first-aid etc.)	1	2	4
6.2 Elimination and substitution	8	7	7
6.3 Engineering controls	7	3	6
6.4 Facilities e.g. showers	8	7	8
6.5 Special equipment	6	6	7
6.6 Safe systems of work	3	3	3
6.7 Permits to work	7	6	7
6.8 Selection and training	1	2	1
6.9 PPE	3	4	7
7.1 Energy	7	2	6
7.2 Confined spaces	7	8	8
7.3 Noise and vibration	7	7	8
7.4 Visual display units	8	8	6
7.5 Radiation	7	7	8
7.6 Off-the-job safety	4	8	7
7.7 Environmental Management	5	7	7
7.8 Tools and equipment	8	4	8

Table 12.6 Differences between the audits

Ranking of the audit questions

- 1 = >10 % of the audit questions
 2 = 10 - 6.5 % of the audit questions
 3 = 6.4 - 4.5 % of the audit questions
 4 = 4.4 - 2.5 % of the audit questions
 5 = 2.4 - 1.5 % of the audit questions
 6 = 1.4 - 1 % of the audit questions
 7 = < 1 % of the audit questions
 8 = 0 % of the audit questions

Differences are shaded

	ISRS	CHASE	QSA
1.1 policy/plans/objectives	1	1	1
1.2 Communication/consultation	1	2	2
1.3 Responsibilities & duties	3	1	2
1.4 Commitment/involvement/promotion	4	7	4
1.5 Compliance	1	4	4
1.6 Auditing	1	2	1
1.7 Resources	5	4	4
2.1 Directors/managers	1	5	3
2.2 Supervisors	3	5	4
2.3 Employees/operatives	1	1	1
2.4 Contractors	6	6	5
2.5 The public (including visitors)	7	7	6
2.6 Health and safety support	5	5	4
2.7 All other people	7	8	4
3.1 Access, egress	7	5	8
3.2 Fixed plant/machinery/fittings	6	3	7
3.3 Transport	7	4	8
3.4 Hygiene, canteens and rest rooms	8	7	8
3.5 Storage facilities	6	4	7
3.6 Heating/lighting	8	8	8
3.7 Housekeeping	6	7	8
3.8 Posters/notice boards	5	8	7
4.1 Work activities/ tasks in general	2	4	5
4.2 Design/plan/commission	5	8	7
4.3 Construct/install/demolish	7	7	7
4.4 Change	4	3	7
4.5 Maintenance/repair/clean	4	2	7
4.6 Materials handling	7	7	5
4.7 Use of substances hazardous to health	3	3	4
4.8 Sale of products and services	7	8	7
5.1 Incident/accident investigation	2	2	2
5.2 Measurement and/or analysis	4	2	3
5.3 Workplace inspections	2	2	3
5.4 Inventories	6	6	6
5.5 Risk assessment	7	5	2
6.1 General risk control implementation	7	6	4
6.10 Health surveillance	6	5	4
6.11 Amelioration (fire, first-aid etc.)	1	2	4
6.2 Elimination and substitution	8	7	7
6.3 Engineering controls	7	3	6
6.4 Facilities e.g. showers	8	7	8
6.5 Special equipment	6	6	7
6.6 Safe systems of work	3	3	3
6.7 Permits to work	7	6	7
6.8 Selection and training	1	2	1
6.9 PPE	3	4	7
7.1 Energy	7	2	6
7.2 Confined spaces	7	8	8
7.3 Noise and vibration	7	7	8
7.4 Visual display units	8	8	6
7.5 Radiation	7	7	8
7.6 Off-the-job safety	4	8	7
7.7 Environmental Management	5	7	7
7.8 Tools and equipment	8	4	8

The audits all devoted a relatively large number of questions (more than 5%) to the following topics:

- policy/plans/objectives;
- employees/operatives;
- incident/accident investigation;
- safe systems of work.

Inventories in all the audits accounted for 1% of the audit, heating and lighting, construction, installation and demolition were less than 1%.

The audits varied in their coverage of the following list of topics (the audit with the greatest number of questions is given in brackets):

- responsibilities and duties (CHASE)
- directors/managers (ISRS)
- supervisors (ISRS)
- access, egress (CHASE)
- plant/machinery/fittings (CHASE)
- transport (CHASE)
- storage facilities (CHASE)
- housekeeping (ISRS)
- posters/notice boards (ISRS)
- work activities/task analysis (ISRS)
- design/planning/commissioning (ISRS)
- change (CHASE)
- maintenance/repair/cleaning (CHASE)
- measurement/analysis (CHASE)
- risk assessment (QSA)
- health surveillance (QSA)
- amelioration (ISRS)
- engineering controls (CHASE)
- personal protective equipment (ISRS)
- energy (CHASE)
- off-the-job safety (ISRS)

12.13 Comparison of ISRS with CHASE

ISRS is compared with CHASE in Table 12.6.

Table 12.7 ISRS compared with CHASE

1 = >10 % of the audit questions 5 = 2.4 - 1.5 % of the audit questions
 2 = 10 - 6.5 % of the audit questions 6 = 1.4 - 1 % of the audit questions
 3 = 6.4 - 4.5 % of the audit questions 7 = < 1 % of the audit questions
 4 = 4.4 - 2.5 % of the audit questions 8 = 0 % of the audit questions

Figures in brackets are percentage number of questions

	ISRS	CHASE
1.1 policy/plans/objectives	1(13)	1 (14)
1.2 Communication/consultation	1	2
1.3 Responsibilities & duties	3	1
1.4 Commitment/involvement/promotion	4	7
1.5 Compliance	1	4
1.6 Auditing	1	2
1.7 Resources	5	4
2.1 Directors/managers	1	5
2.2 Supervisors	3	5
2.3 Employees/operatives	1(17)	1(12)
2.4 Contractors	6 (1.4)	6 (1.1)
2.5 The public (including visitors)	7 (0.7)	7 (0.5)
2.6 Health and safety support	5 (1.6)	5 (2.2)
2.7 All other people	7	8
3.1 Access, egress	7	5
3.2 Fixed plant/machinery/fittings	6	3
3.3 Transport	7	4
3.4 Hygiene, canteens and rest rooms	8	7
3.5 Storage facilities	6	4
3.6 Heating/lighting	8 (0)	8 (0)
3.7 Housekeeping	6	7
3.8 Posters/notice boards	5	8
4.1 Work activities/ tasks in general	2	4
4.2 Design/plan/commission	5	8
4.3 Construct/install/demolish	7(0.5)	7 (0.3)
4.4 Change	4	3
4.5 Maintenance/repair/clean	4	2
4.6 Materials handling	7 (0.7)	7 (0.3)
4.7 Use of substances hazardous to health	3 (5.0)	3 (5.1)
4.8 Sale of products and services	7	8
5.1 Incident/accident investigation	2 (10)	2 (6.8)
5.2 Measurement and/or analysis	4	2
5.3 Workplace inspections	2 (6.9)	2 (8.7)
5.4 Inventories	6 (1.2)	6 (1.1)
5.5 Risk assessment	7	5
6.1 General risk control implementation	7	6
6.10 Health surveillance	6	5
6.11 Amelioration (fire, first-aid etc.)	1	2
6.2 Elimination and substitution	8	7
6.3 Engineering controls	7	3
6.4 Facilities e.g. showers	8	7
6.5 Special equipment	6 (1.4)	6 (1.3)
6.6 Safe systems of work	3 (6.1)	3 (4.9)
6.7 Permits to work	7	6
6.8 Selection and training	1	2
6.9 PPE	3	4
7.1 Energy	7	2
7.2 Confined spaces	7	8
7.3 Noise and vibration	7 (0.2)	7 (0.2)
7.4 Visual display units	8 (0)	8 (0.0)
7.5 Radiation	7 (0.2)	7 (0.3)
7.6 Off-the-job safety	4	8
7.7 Environmental Management	5	7
7.8 Tools and equipment	8	4
TOTAL (shaded percentages)	65.9	58.8

ISRS is compared with QSA in Table 12.8.

Table 12.8 ISRS compared with QSA

1 = >10 % of the audit questions 5 = 2.4 - 1.5 % of the audit questions
 2 = 10 - 6.5 % of the audit questions 6 = 1.4 - 1 % of the audit questions
 3 = 6.4 - 4.5 % of the audit questions 7 = < 1 % of the audit questions
 4 = 4.4 - 2.5 % of the audit questions 8 = 0 % of the audit questions

Figures in brackets are percentage number of questions

	ISRS	QSA
1.1 policy/plans/objectives	1 (13)	1 (15)
1.2 Communication/consultation	1	2
1.3 Responsibilities & duties	3	2
1.4 Commitment/involvement/promotion	4 (3.8)	4 (3.9)
1.5 Compliance	1	4
1.6 Auditing	1 (24)	1 (18)
1.7 Resources	5	4
2.1 Directors/managers	1	3
2.2 Supervisors	3	4
2.3 Employees/operatives	1 (17)	1 (18)
2.4 Contractors	6	5
2.5 The public (including visitors)	7	6
2.6 Health and safety support	5	4
2.7 All other people	7	4
3.1 Access, egress	7	8
3.2 Fixed plant/machinery/fittings	6	7
3.3 Transport	7	8
3.4 Hygiene, canteens and rest rooms	8 (0.0)	8 (0.0)
3.5 Storage facilities	6	7
3.6 Heating/lighting	8 (0.0)	8 (0.0)
3.7 Housekeeping	6	8
3.8 Posters/notice boards	5	7
4.1 Work activities/ tasks in general	2	5
4.2 Design/plan/commission	5	7
4.3 Construct/install/demolish	7(0.5)	7 (0.6)
4.4 Change	4	7
4.5 Maintenance/repair/clean	4	7
4.6 Materials handling	7	5
4.7 Use of substances hazardous to health	3	4
4.8 Sale of products and services	7(0.2)	7 (0.6)
5.1 Incident/accident investigation	2 (10)	2 (10)
5.2 Measurement and/or analysis	4	3
5.3 Workplace inspections	2	3
5.4 Inventories	6 (1.2)	6 (1.2)
5.5 Risk assessment	7	2
6.1 General risk control implementation	7	4
6.10 Health surveillance	6	4
6.11 Amelioration (fire, first-aid etc.)	1	4
6.2 Elimination and substitution	8	7
6.3 Engineering controls	7	6
6.4 Facilities e.g. showers	8 (0.0)	8 (0.0)
6.5 Special equipment	6	7
6.6 Safe systems of work	3 (6.1)	3 (4.8)
6.7 Permits to work	7 (0.7)	7 (0.1)
6.8 Selection and training	1 (11)	1 (11)
6.9 PPE	3	7
7.1 Energy	7	6
7.2 Confined spaces	7	8
7.3 Noise and vibration	7	8
7.4 Visual display units	8	6
7.5 Radiation	7	8
7.6 Off-the-job safety	4	7
7.7 Environmental Management	5	7
7.8 Tools and equipment	8 (0.0)	8 (0.0)
TOTAL (shaded percentages)	87.5	83.2

CHASE is compared with QSA in Table 12.9.

Table 12.9 CHASE compared with QSA

1 = >10 % of the audit questions 5 = 2.4 - 1.5 % of the audit questions
 2 = 10 - 6.5 % of the audit questions 6 = 1.4 - 1 % of the audit questions
 3 = 6.4 - 4.5 % of the audit questions 7 = < 1 % of the audit questions
 4 = 4.4 - 2.5 % of the audit questions 8 = 0 % of the audit questions

Figures in brackets are percentage number of questions

	CHASE	QSA
1.1 policy/plans/objectives	1 (14)	1(15)
1.2 Communication/consultation	2 (8.9)	2 (7.4)
1.3 Responsibilities & duties	1	2
1.4 Commitment/involvement/promotion	7	4
1.5 Compliance	4 (4.3)	4 (4.5)
1.6 Auditing	2	1
1.7 Resources	4 (4.1)	4 (3.4)
2.1 Directors/managers	5	3
2.2 Supervisors	5	4
2.3 Employees/operatives	1 (12)	1 (18)
2.4 Contractors	6	5
2.5 The public (including visitors)	7	6
2.6 Health and safety support	5	4
2.7 All other people	8	4
3.1 Access, egress	5	8
3.2 Fixed plant/machinery/fittings	3	7
3.3 Transport	4	8
3.4 Hygiene, canteens and rest rooms	7	8
3.5 Storage facilities	4	7
3.6 Heating/lighting	8 (0.0)	8(0.0)
3.7 Housekeeping	7	8
3.8 Posters/notice boards	8	7
4.1 Work activities/ tasks in general	4	5
4.2 Design/plan/commission	8	7
4.3 Construct/install/demolish	7(0.3)	7(0.6)
4.4 Change	3	7
4.5 Maintenance/repair/clean	2	7
4.6 Materials handling	7	5
4.7 Use of substances hazardous to health	3	4
4.8 Sale of products and services	8	7
5.1 Incident/accident investigation	2 (6.8)	2 (10)
5.2 Measurement and/or analysis	2	3
5.3 Workplace inspections	2	3
5.4 Inventories	6 (1.1)	6 (1.2)
5.5 Risk assessment	5	2
6.1 General risk control implementation	6	4
6.10 Health surveillance	5	4
6.11 Amelioration (fire, first-aid etc.)	2	4
6.2 Elimination and substitution	7 (0.3)	7 (0.1)
6.3 Engineering controls	3	6
6.4 Facilities e.g. showers	7	8
6.5 Special equipment	6	7
6.6 Safe systems of work	3 (4.9)	3 (4.8)
6.7 Permits to work	6	7
6.8 Selection and training	2	1
6.9 PPE	4	7
7.1 Energy	2	6
7.2 Confined spaces	8	8
7.3 Noise and vibration	7	8
7.4 Visual display units	8	6
7.5 Radiation	7	8
7.6 Off-the-job safety	8	7
7.7 Environmental Management	7(0.8)	7 (0.9)
7.8 Tools and equipment	4	8
TOTAL (shaded percentages)	57.5	65.9

The similarities as shown by an exact match between ranking numbers in the table were converted back into percentage number of questions. These percentages were then added up to establish the percentage of the audit that was similar to the other one. The resulting figures were as follows:

- 66% of ISRS covered the same topics that were covered by 59% of CHASE.
- 87% of ISRS covered the same topics that were covered by 83% of QSA.
- 66% of QSA covered the same topics that were covered by 58% of CHASE.

Therefore there is more similarity between the content of ISRS and QSA than there is with the content of CHASE. The content of CHASE is as much like ISRS as it is like QSA.

12.14 Conclusions

The main table produced from the database results, Table 12.1 is a useful method of comparing proprietary audits. The other tables generated from the results are a demonstration of further analysis that can be carried out on results if required. Results could also be presented as graphs and pie charts to show differences and similarities between question sets.

CHAPTER 13

Review of Results

13.1 Introduction

This research has concentrated on developing a method for assessing health and safety audits. Rather than look at audit chapter and section headings the research has looked at the questions which make up an audit. Methods have been developed for categorising these questions to enable comparisons of the different audits. The other purpose of categorising the questions was to provide information to assess whether the present approach to auditing is correct or whether changes need to be made to improve the efficiency and benefits to be gained from auditing.

13.2 The print-based categorisation

The first categorisation was done by placing a topic code alongside each question in two proprietary audit manuals ISRS and CHASE II. By the end of the process there were 32 categories or topic codes and each question fitted into one of the categories. The number of questions falling in to each category was calculated and it was found that there were a number of similarities and differences between the audits. The conclusion was drawn that one of the audits concentrated more on safety organisation than the other audit which concentrated to a greater extent on specific risk control measures.

13.3 Word profiling

A second categorisation method was developed to be less subjective than the first method and to be less time consuming. There were hundreds of questions in the audits and therefore it was very time consuming to examine each question in turn and decide what safety topic it covered. Firstly the feasibility of using an expert system shell was considered before deciding to use a word counting method. Before embarking on using word counting it was necessary to enter the text of nearly one thousand audit questions onto a computer. Then a word profiler in a grammar checking programme called Grammatik was used to count the number of words in each audit. This could be done in a matter of minutes but it took much longer to analyse the results. It was necessary to identify key words which were characteristic of a particular safety topic. The list of safety topics from the first categorisation were assigned key words. The number of key words in the audit were then compared with the number of questions assigned to this category in the first categorisation. There were a number of fairly good matches which was encouraging for the use of the word count technique.

13.4 Workplace study

A trial was carried out to determine if useful information about the style and content of proprietary audits could be obtained by using the audits to measure safety performance in the workplace. The trial showed that it is unsatisfactory to leave question sets with

organisations for completion unless they are already involved in a programme of auditing. Therefore research studies in the workplace should involve existing users. The disadvantage of this approach is that two audits cannot be compared with one another in the same workplace unless a new audit is introduced. It was decided not to do any further work in the field as information on question style and content could be obtained more easily by developing an efficient categorisation system. The workplace assessment however confirmed that criteria such as prescription and professional judgement affect the success of an audit and should be taken into account in evaluation of audit systems.

13.5 Multi-tagging of questions

The problem with the first categorisation was that it only allowed for each question to be put into one category. A multi-tagging system was therefore devised using a table in a word processing application. The questions were put in rows in a table and columns were created for each code or group of codes that were required. Different coding methods were tried out. For instance an attempt was made to code questions according to the headings used in the HSE (1991) i.e. policy, organising, planning and implementing, measuring performance, auditing and reviewing performance. This proved to be very difficult as the questions did not lend themselves to being placed in these categories. Other models used included the Occupational Health and Safety Practitioners functional map (NVQ 1993) and categories from the HSE Accident Reporting Form. None of these categories proved to be successful for sorting audit questions. A new system containing 96

topics developed by Booth (1993) was therefore considered. However, with such a large number of categories the use the tabular method was very slow and onerous. A switch was therefore made to the use of a database program for evaluating questions.

13.6 Control outcome and prescription categorisation

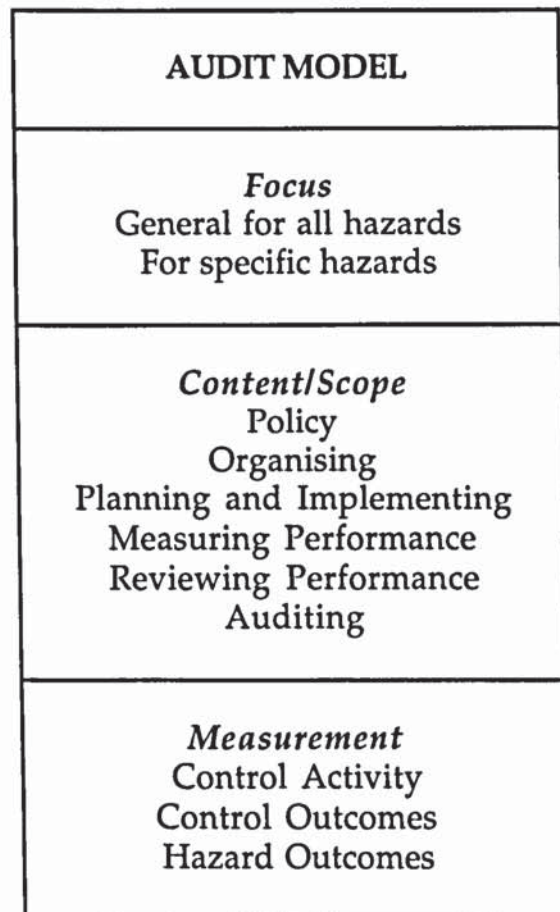
Prior to developing a database categorisation a simpler coding system was tried out to assess how prescriptive the questions were and whether they looked at control activity or control outcomes as defined by Dawson (1983). Using word processing software a table was created and the questions coded according to whether they were a legal requirement, a condition of the audit, whether they required professional judgement and whether they examined the outcome of control activities i.e. success or failure in risk control. This lead on from the observation that audits had a tendency to ask questions about for example awareness of legal requirements and standards but did not asked the all important question: does the company comply with the legal requirement? The categorisation showed that the audits appeared to ask more probing questions that sometimes related to 'control outcomes' or successful risk control in one of three ways:

- they often required professional judgement using words such as 'how effective';
- they often asked for information on percentage compliance;
- in ISRS they often asked how often a given activity had been carried out.

It was concluded that how probing questions were was an important element of an audit and should be included in any categorisation system.

13.7 Audit model

An audit model was constructed to focus on what was perceived to be the different aspects of an audit from the information that had been obtained from the print-based categorisation, word profiling and the 'control outcome' work.



For example an audit might focus on the OH&S management of particular hazards. Auditing the OH&S management system for these

hazards could involve examining control activity, control outcomes or hazard outcomes. However, it was concluded that audit questions do not fit neatly into the management elements and that it is difficult to make a precise distinction between a control activity question and a control outcome question. Therefore audit questions need to be categorised with more headings than those given in the model.

13.8 The database categorisation

A database manufactured by Claris called FileMaker Pro 2.1 was obtained. Use of the database allowed more detailed categorisation systems to be considered and also allowed the use of word searching for categorising questions. The 96 category list was modified to overcome repetition and to make it suitable for word searching. Sometimes it was necessary to compromise between the ideal category and the category that would be best suited to word searching. The system was entered into the database and used to sort the questions in ISRS, CHASE and QSA. Word searching proved to be a quick, efficient method of identifying which categories the questions should be coded under. Having completed the word search exercise it was possible to find all questions that had not been coded. This was a major advantage of using the database compared with word counting with the Grammatik Word Profiler. Initially a lot of questions were not coded by word searching alone. This was partly because more key words needed to be added to the searches and partly because supporting text had not been entered on the question field. When entering questions in the database any supporting text given such as an introductory paragraph should be included in the field so that each question stands alone. This

does not affect the results because any code can only be assigned to a question once regardless of how many key words of interest are found in the question. It is considered that the system should be able to sort by word searching about 90% of questions. In a typical audit of about 500 questions this would leave about 50 questions to be sorted manually. It is anticipated therefore that an audit could be evaluated for content in about 2-3 hours.

13.9 Comparison of ISRS, CHASE and QSA

Content profiles for the proprietary audits: ISRS, CHASE and QSA were produced using the database categorisation method. Although the audits were weak in some areas and stronger in others there was no complete mismatch between the three audits evaluated. The most noticeable difference between the three audits was the number of questions directed at managers. In ISRS there were far more questions with a requirement for management involvement than in the other two audits. CHASE had few questions on safety culture issues such as commitment, promotion of health and safety. QSA for the size of the audit had relatively few questions on amelioration (first-aid, emergency planning and fire) and very few questions about workplace conditions.

13.10 Accuracy of the method

If audit producers looked through the results from the database categorisation their general reaction might be: we already know that! For instance that ISRS has many questions on management

involvement, Chase does not include safety culture issues etc. The fact that the database categorisation has produced results that could be determined by searching through literature on the audit, speaking to producers and users suggests that the method is valid. The difference with this method is that the information can be obtained quickly without searching through literature or by having to use the audit for several years before discovering its strengths and limitations.

13.11 General approach to auditing

The database profiles show the approach to auditing at presently prescribed by the proprietary audits. The approach is one of trying to provide a comprehensive audit. None of the audits adopted the approach suggested by Tweedale (1993) that audits should cover the broad field superficially and selected parts in detail. This research did not set out to establish what the structure of an audit should be. However, the present content and style of proprietary audits suggest that the points mentioned in the next paragraphs need to be considered by designers and users of proprietary audits.

13.12 Audits modelled on OH&S management systems

There is a trend at the moment to design audits along the lines of the OH&S management system described in HSE (1991). This is considered to be partly because by doing so there is the implication that the audit is approved by HSE. It is important that a distinction is made between an OH&S management system and an audit. The objectives of an audit are to assess the overall capability of a OH&S system, identify strengths

and weaknesses, and verify that an organisation carries out and achieves what it claims to do (BSI 1995). An audit simply needs to be designed to be an audit rather than an OH&S management system.

13.13 Outcome data

To assess the overall capability of a OH&S management system requires outcome data. Dawson (1982) proposes that there are two types of outcome data: 'control outcomes' and 'hazard outcomes.'. Control outcomes are successful or unsuccessful risk control and hazard outcomes are accidents. This research showed that control outcome questions are few and far between in a proprietary audit. But what is included are questions which are more probing than others. Between the two extremes of questions that look solely at control 'activities' and questions that consider control 'outcomes' are a number of questions which probe deeply into whether a control activity has been carried out and whether it is successful. It is these questions in a proprietary audit that must be given the highest weighting. This is not always the case as was shown by Eisner & Leger (1988). In the mine version of ISRS 260 points were available for establishment of rules and procedures and only 40 points for rule compliance as observed by the field auditors.

13.14 Professional Judgement

The database categorisation showed that CHASE had a large number of professional judgement questions. These questions are useful in that they can go further to establishing whether risk control is successful than more prescriptive questions and they allow some flexibility in the

flexibility in the audit. However, they can be difficult to answer and difficult to weight correctly. When at all possible information provided in 'help' sections or 'help' screens on computers should be incorporated in the text of the question. There is also sometimes a requirement for more lead in or build up into a professional judgement question.

13.15 Emphasis on engineering control activity compared with health and safety organisation

The very first print based categorisation and the later database categorisation showed that CHASE had more questions on engineering control than ISRS. Smith (HSE 1992) found that safety professionals in the UK considered that engineering controls should be given a higher weighting in ISRS. The proprietary audit evaluated that was based on a OH&S management system had few questions on engineering control and workplace conditions. The balance in an audit between engineering control and safety organisation needs to be closely scrutinised. It is to be expected that control 'outcome' questions that should be given the highest weighting in an audit will be found in greater numbers in questions covering specific control measures.

13.16 Performance standards

Performance standards are another way of describing what is reasonably practicable in any situation. An organisation should set its own performance standards according to the level of risk. They must at least confirm with minimum legal standards and take into account

the well established hierarchy of controls i.e. elimination and substitution, engineering control, safe systems of work and personal protective equipment. One of the audits evaluated namely QSA was stated as being based on performance standards. However, it was not made clear what this meant. In practice all it seemed to imply was that the audit considered control measures for a few named hazards.

13.17 Terminology

Throughout this research it was found that the terminology associated with all means of measuring, monitoring or auditing health and safety performance was confusing. For instance, it is quite easy to understand that 'reactive monitoring' refers to accident data but why have HSE (1991) included within in this group weaknesses and omissions in performance standards? Surely this is active monitoring. There needs to more guidance made available to organisations on the difference between continuous monitoring (or measuring) of safety performance and audits.

13.18 Future proprietary audits

Proprietary audits need to be in general more focused and better structured. Tarrant (1980) wrote an excellent system can be developed that tells when a problem exists but does not in itself give any solutions. Proprietary audit systems perhaps tend to try and give too many solutions without identifying the problems. Thus they concentrate on prescribing what should be done rather than identifying strengths and weaknesses in what already exists. Successful audits

need to include some questions that verify that the OH&S management system is as it should be and some which probe into the success of control measures. Many of the questions that are presently in audits may not need to be there at all. An audit needs to be structured to facilitate the auditing process e.g. people oriented, hazard oriented. Whatever, makes the audit easiest to complete and assimilate the results.

13.19 Use of the database

An understanding of the present content and style of proprietary audits can help organisations realise the limitations of the audits and can be useful in the design of future audits. This research evaluated three proprietary audits but the technique could be applied to any auditing system. For instance more information could be obtained by evaluating other proprietary audits such as CHASE III, COURSAFE, SHARP and PROFILE. The categorisation system could facilitate the identification of probing questions in an audit to ensure they are given sufficient weighting. It could also be used to study the balance of audits i.e. the number of questions on different topics. Many companies now tailor a proprietary audit to their own needs. It would be useful to compare a database profile of a tailored audit against the original proprietary audit. Thus this research by providing a means of evaluating existing audits should enable more effective auditing to be carried out in the future.

CHAPTER 14

Conclusions and further work

14.1 Categorisation technique

This research has shown that it is possible to assess the content and style of proprietary auditing systems using a combination of word counting techniques and manual sorting of questions with a multi-tagging categorisation system. Word counting is an objective method of assessment and can be carried out by non-experts. Manual sorting of questions requires a degree of concentration and attention to detail which is difficult to sustain for too many audit questions. However, if an initial sorting by word searching leaves just 10% of the audit or approximately 50 questions to sort manually, the task is easily manageable and can be carried out quickly with a high degree of accuracy. Thus the combination of word counting and manual sorting is a useful technique for the classification of audit questions.

14.2 Application of the technique

The technique described was applied successfully to three proprietary audits. The method could be applied to all proprietary health and safety auditing systems. The audit questions need to be imported into the database. This can be done by typing the questions into a computer, by scanning a hard copy and using character recognition software to

create a text file or by assessing an existing computer file of the questions.

14.3 Fields outside health and safety

Although the technique was applied to health and safety audits the same methodology could be applied to, for example, quality audits or environmental audits. To do this would require a modification of some of the categories and some of the key words but not all. Some categories such as management involvement and commitment apply equally well to audits on quality or environmental management.

14.4 Evaluation of three proprietary audits

The content profiles obtained for the three proprietary audits ISRS, CHASE and QSA showed that although the audits were weak in some areas and stronger in others that there was no complete mismatch between the audits. They all took a comprehensive approach to auditing. ISRS had considerably more questions about management involvement in health and safety. CHASE had few questions on safety culture issues such as commitment and promotion but a greater number of questions on engineering controls, plant, machinery and transport. QSA had the most questions on risk assessment but relatively few on amelioration (first-aid, emergency planning and fire) and workplace conditions.

14.5 Proprietary audits are reactive rather than pro-active

The proprietary audits assessed had many more questions on accident reporting and investigation than on risk assessment. This was even true for QSA which had considerably more questions on risk assessment than the other audits. Thus the audits are more reactive than pro-active. UK legislation is now based on risk assessment and cost-benefit analysis and it is considered that this should be reflected in proprietary audits.

14.6 Measuring successful OH&S management

The research showed that questions which probe into the success of risk control measures that were called 'control outcome' questions were few and far between in the proprietary audits evaluated. A successful audit should include more probing questions and these should be given a higher weighting than less probing 'control activity' questions.

14.7 Future proprietary audits

The research found that the difference between the need to continuously monitor health and safety performance and the need to have a periodic external audit carried out was confused. The purpose of an audit as perceived by HSE(1991) was different from the objectives of some proprietary audits. The proprietary audits try to be more comprehensive than perhaps is really required for a periodic audit. Proprietary audits tend to concentrate on prescribing what should be

done rather than identifying strengths and weaknesses in what already exists. They tend to be reactive rather than pro-active. Thus it is concluded that the scope of proprietary audits need to be better defined, they must be more pro-active and should focus on identifying strengths and weaknesses rather than providing solutions.

14.8 Further work

The following are recommended as proposals for further work:

1. The database categorisation developed for this research or a similar content evaluation technique should be used to assess more proprietary audit question sets to provide a greater depth of knowledge on proprietary audits.
2. A content evaluation technique should be applied to the question sets of audits that have been tailored by user companies to suit their own needs. The tailored question set profile should then be compared with the original proprietary audit profile.
3. Information on question scores should be included in a content evaluation and used to establish the weighting given to different topics in proprietary audits.
4. Research is required into what questions can be used to assess control outcomes in an audit and the weighting that should be given to these questions.

5. Research should be carried out on how audits are conducted and how to design a proprietary audit to facilitate the auditing process.
6. Research is required on the composition of audit teams. Particularly with reference to the role of the workforce representative as discussed in paragraph 5.4 in Chapter 5.
7. Research is required on how to design an audit based on the principles of risk assessment.

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APPENDIX 1

Word Profile for ISRS

***** Word Frequency - 556 *****
 and
 ***** Word Frequency - 473 *****
 the
 ***** Word Frequency - 432 *****
 of
 ***** Word Frequency - 342 *****
 to
 ***** Word Frequency - 226 *****
 are
 ***** Word Frequency - 205 *****
 is
 ***** Word Frequency - 183 *****
 safety
 ***** Word Frequency - 181 *****
 in
 ***** Word Frequency - 179 *****
 for
 ***** Word Frequency - 175 *****
 health
 ***** Word Frequency - 166 *****
 a
 ***** Word Frequency - 142 *****
 or
 ***** Word Frequency - 116 *****
 control
 ***** Word Frequency - 115 *****
 with
 ***** Word Frequency - 110 *****
 management
 ***** Word Frequency - 109 *****
 every
 ***** Word Frequency - 98 *****
 all loss
 ***** Word Frequency - 91 *****
 months

***** Word Frequency - 80 *****
 how there
 ***** Word Frequency - 79 *****
 training
 ***** Word Frequency - 77 *****
 by
 ***** Word Frequency - 74 *****
 as have programme
 ***** Word Frequency - 69 *****
 been
 ***** Word Frequency - 66 *****
 task
 ***** Word Frequency - 62 *****
 an at equipment
 ***** Word Frequency - 60 *****
 not
 ***** Word Frequency - 59 *****
 often
 ***** Word Frequency - 53 *****
 employees
 ***** Word Frequency - 51 *****
 procedures used
 ***** Word Frequency - 50 *****
 appropriate made percentage
 ***** Word Frequency - 49 *****
 employee
 ***** Word Frequency - 48 *****
 done
 ***** Word Frequency - 47 *****
 yearly
 ***** Word Frequency - 46 *****
 determine does organisation
 personnel
 ***** Word Frequency - 45 *****
 written
 ***** Word Frequency - 42 *****

compliance critical each
on personal

***** Word Frequency - 41 *****

communicated that

***** Word Frequency - 40 *****

general what

***** Word Frequency - 39 *****

accident major records
related which

***** Word Frequency - 38 *****

do has other

***** Word Frequency - 37 *****

controls meetings

***** Word Frequency - 36 *****

emergency

***** Word Frequency - 35 *****

least standards

***** Word Frequency - 33 *****

review

***** Word Frequency - 32 *****

analysis evaluation results

***** Word Frequency - 31 *****

fire identify incident

***** Word Frequency - 30 *****

follow-up procedure rules

***** Word Frequency - 29 *****

following materials planned
protective required these

***** Word Frequency - 28 *****

hazards inspections investigation

***** Word Frequency - 27 *****

accidents engineering formal
occupational

***** Word Frequency - 26 *****

group

***** Word Frequency - 25 *****

indicate practices reports
system units work

***** Word Frequency - 24 *****

senior unbiased

***** Word Frequency - 23 *****

being completed evaluate
identified physical their
within

***** Word Frequency - 22 *****

analyses hazardous include
items managers programmes
such

***** Word Frequency - 21 *****

actions areas conducted
established from potential
s years

***** Word Frequency - 20 *****

observation off-the-job requirements
tasks

***** Word Frequency - 19 *****

audit be first-aid

***** Word Frequency - 18 *****

distributed ensure information
middle supervisors techniques

***** Word Frequency - 17 *****

adequate chemical conditions
damage given inspection
orientation purchasing received

***** Word Frequency - 16 *****

causes induction maintained
new objectives reviewed
this when whether

***** Word Frequency - 15 *****

audits followed included
policy proper

***** Word Frequency - 14 *****

action basic complete
medical number performance
storage surveys

***** Word Frequency - 13 *****

during illnesses job
organisational person process
rates were writing

***** Word Frequency - 12 *****

above changes form
high injury operating
past property recorded
report reporting subjects
substances team

***** Word Frequency - 11 *****

activities basis central
communications condition current
family file frequency
incidents level list
maintenance material promotion
standard taken those
use where who

***** Word Frequency - 10 *****

about adequacy annual
co-ordinator facilities initial
injuries levels month
needs protection provided
responsibility specialised three
through working

***** Word Frequency - 9 *****

administration available design
hours if instruction
it legislation manager
observations outside parts
plans problems properly
quality receive regular
remedial reported services
signs special substandard
time transferred two
year

***** Word Frequency - 8 *****

awards based bulletin
conduct conducting data
department etc exposures
illness members must
occupations persons prior
random requiring tests
they updated was
well

***** Word Frequency - 7 *****

actual capability committees
comprehensive computed contacts
day developed directive
environmental factors frequently
good housekeeping indicated
into investigations joint
kept leadership legislative
local location make
near one out
placement policies prevention
project qualified recognition
sampling supervisor survey
systems than types

***** Word Frequency - 6 *****

accepted accordance after
agencies aids annually
any campaign changed

clearly committee corrective
costs course designated
directives effectively establishes
examination groups hazard
held her lesson
many measurement numbers
observed organisation's over
plan recognised record
regulations reinforce rule
safe severity specific
specifications stored supervisory
topics total trained
underlying valves waste

***** Word Frequency - 5 *****

actively attention biological
boards check codes
colour-coding corrections cost
count departments devices
disciplinary disposal documents
elements encourage event
examinations exposure eye
first forms guide
handling hiring his
hygiene immediate insurance
involved knowledge later
locations methods misses
mobile need no
once pre-employment pre-placement
pre-use preparedness problem-solving
reference regularly relevant
require risks sheets
significant skill specified
statement statistical statistics
treatment verify

***** Word Frequency - 4 *****

analysed application appointed
approved area competitions
consultant contractor contractor's
corrected degree develop
development different discussed
drills effectiveness emergencies
employee's ensures evaluated
exposed fires give
giving governmental individual
informed inventory key
known machinery master
measurements monitoring near-misses
needing next obtained
obtaining order others
periodic permits posted
priorities processes progress
projects receiving recognitions
recommended repetitive rescue
residual responsibilities retraining
reviewing risk same
selection session situations
so spot structured
sufficient summaries supply
support switches teams
telephone tours toxic
twelve validity vital
whenever

***** Word Frequency - 3 *****

access accurate achieved
acts addition adequately
advance agency agents
also announcement applicable

applied appropriately aspects
 assigned assigns assist
 aware awareness base
 business campaigns can
 care carried causal
 certificates checklist checklists
 checks cleaning colour
 company completion consideration
 considerations construction containing
 contests controlled copy
 corporate courses date
 dealing define description
 designed detect devoted
 discharges documented due
 effects either evacuation
 evaluations fatalities few
 files frames function
 guarding hour identifies
 includes industrial industry
 instructions introduction labelled
 labelling languages length
 lighting listed located
 lock-out magazines majority
 management's manual materials-
 handling
 measures meet meeting
 member modification most
 name necessary newsletter
 off-site overall part
 participate pji place
 point posters power
 practice present preventive
 probable products prominently
 promotional properties provide
 public recent recommendations
 relationship releases representatives
 requires respirators result
 resulting reviews rooms
 see space substantiated
 suppliers systematic temperature
 test testing tips
 translated type understand
 ventilation visual water
 will workplace

***** Word Frequency - 2 *****

accessibility accessible accidental
 addresses advanced advice
 advisor agreements aid
 aide air allotted
 alternate apply appraisal
 approval assignment attendance
 audiometric average baths
 between case catalogues
 chairman change check-off
 checked chemicals clean-up
 co-ordination colour-codes commendation
 communication compared competency
 compiled composition conception
 conclusions confined conservation
 consider considered contained
 contents contest contract
 contracts contractual contribution
 copies correct coverage
 covered damaged deal
 deaths defined delays
 detection direct directed
 directly dispensing displayed
 education eliminated employer
 employment energy enforcement
 engineer evidence examined
 excavation excellent exist
 exists extinguishers extremes

facility fair field
 firms five flow
 follow formally forwarded
 full-time generated government
 grounds guidance head
 high-potential hospitals hot
 identification ill illumination
 immediately implementation importance
 initiated injured input
 instructed interest internal
 investigated investigator item-for-item
 its knowledgeable labels
 lack law legal
 legislated less letters
 library licenses licensing
 making manufactured marking
 may message miss
 monitor monitored named
 near-miss needed noise
 non-compliance none normal
 notification occurred on-site
 ongoing orally organised
 partial participates participation
 people percentages perception
 poor positions possible
 premises presentations previous
 priority problem production
 proficiency promote protected
 providing provision published
 quantities quarterly radiation
 readily realistic reasons
 recordable referred refusal
 removal respond return
 revision scrap security
 segments segregation separately
 service serviceability set
 shared showers shown
 signatures signed site
 smoke sources specialists
 spills staffed stage
 state structures supplied
 supporting tags take
 teaching tested them
 timeliness timely title
 up update upon
 usage using valid
 various ways winners
 would yes zero

***** Word Frequency - 1 *****

absorbent accomplished account
 accountable accumulation acquiring
 active activity acuity
 adaptation additional address
 addressed administer administering
 administrative affect age
 agenda aimed aisle
 alarm alarms allowed
 along already ambulances
 amount announcements appointment
 approach approving articles
 assess assigning attendants
 attending audio audio-visual
 authority availability award
 awarding banquets before
 behaviour bias bid
 blankets body booklets
 books breakdowns building
 bulletins cables cafeterias
 calculation capabilities capacity
 carry carrying cases
 cause centres certain

certificate	chains	chairmen	keep	kind	kinds
characteristics	chief		ladders	last	layout
circulated	circulation	civil	leader	leaders	leads
classifications	classified		legislatively	liability	life
classify	cleanliness	clear	lifting	light	line
clearance	climbing	co-operation	literature	loan	lock
co-ordinator's	co-ordinators	coaching	lock-off	look	lunch
coding	colour-coded	colour-codings	luncheons	machine	maintain
commitment	community	company's	maintaining	manager's	manuals
comparative	comparing	comparison	maps	matter	matters
compatibility	competition	completely	maximise	measure	measured
comply	compressed	concerned	mechanical	memos	mentioned
concerns	confidential	confidentially	messages	met	method
confirmation	connection	connections	minimised	minimising	minimum
consistency	contact	contain	minutes	mists	modified
container	containers	containment	modify	monthly	moth
content	continuing	contracted	motivate	mounting	mutual
contractors	cords	costed	n.a	names	nature
coverages	criteria	critiques	newsletters	nip	non-disabling
cumulative	cutting	cylinders	non-disposable	non-supervisory	noticed
daily	dates	day-to-day	notifications	notified	notify
decisions	decorations	defects	occasions	occupation	occur
defence	definite	deluge	occurs	offers	officer
demonstration	department's	departmental	offices	old	on-compliance
depth	descriptions	designate	operated	operations	operators
designation	designer	designers	opportunity	opposed	oral
desired	detailed	details	orders	organisations	orientations
deterioration	determined	determining	oriented	original	outlets
developing	developments	dimensions	outlines	oxidation	packaged
disabling	discuss	disposed	packs	part-time	participants
disposing	distribution	divided	participating	per	performed
division	doctors	doing	peripheral	permanent	permit
doors	dosimeters	downs	person-to-person		pertinent
drainage	drill	duplicate	phrases	piece	placed
dust	duties	e.g.	planning	points	poison
edges	effective	eighteen	police	pollution	portable
electrical	element	emphasis	positive	post-course	poster
employ	employers	enables	postings	pre	pre-audit
encountered	encourages	enough	pre-existing	pre-job	precautions
enter	entered	entire	predetermined	preparation	prepared
entirety	entrusted	entry	presence	presented	presses
ergonomic	ergonomics	es	pressure	prevent	preventative
escape	essential	establishing	prevented	professional	promoted
exceed	exclusively	existing	prompt	proportion	publications
exit	exits	experience	publish	purchase	purchased
explosions	extensively	extent	purpose	purposes	qualifications
external	extinguishing	eyesight	questionnaire	questionnaires	questions
factor	fairs	familiar	radio	rate	ratings
feedback	fighting	filed	re-entry	re-issue	reaches
filing	findings	fire-fighting	readable	reassigned	receipt
fitting	fixtures	flammable	recovery	recurrence	references
flammables	format	formats	reflecting	refresher	refuse
former	formulate	forward	relating	repaired	repairs
four	fuels	fumes	replacement	representative	requesting
functions	furnishing	future	requests	restoration	restraints
gas	gases	gear	restricted	retain	retardant
generally	glare	governing	retardation	retention	right
group's	guides	had	roads	room	rotating
hand	handle	harmed	route	safeguard	satisfactory
having	he	help	scene	schedule	school
high-loss	higher	him	scoring	seals	search
historical	hold	holds	section	sectional	selected
homes	hose	hospital	sent	serviceable	several
hydro-carbons	i.e.	i.e.	she	shear	shelf
i.e.	i.e.	i.e.	shift	shipping	shops
i.e.	identifying	implemented	should	show	showing
important	improvement	inactive	shut-down	shut-off	shutdown
inadequate	including	incorporated	similar	sites	six
increase	individual's	informal	size	solutions	solving
initiating	inspected	installation	soon	sound	speakers
instructional	instrumentation	insurer	specifies	spill	sprinkler
interpreting	interruption	interruptions	stability	stacking	stacks
interviews	isrs	issue	staff	stages	standardise
issued	item	jobs	start-up	statistically	status

steps	storing	stress
stresses	stressing	stretchers
structure	subject	substance
suitable	suitably	surfaces
surplus	suspected	symbols
systematically	tag	tag-out
talk	team's	technique
tell	terms	texts
themes	theses	thorough
together	tools	topic
tour	toward	transfer
transmission	transportation	treated
tv	twice	uncover
understanding	union	unique
unobstructed	unrestricted	unusual
up-to-date	utilised	validate
vapours	vaults	vehicle
vibration	vicinity	view
violation	violators	visibility
visible	vision	volume
walking	warehousing	way
wear	weather	week
weekly	wiring	work-related
work-shut	workers	worst
you	your	

APPENDIX 2

Word Profile for CHASE

***** Word Frequency - 182 *****

the

***** Word Frequency - 179 *****

of

***** Word Frequency - 177 *****

and

***** Word Frequency - 124 *****

are

***** Word Frequency - 110 *****

for

***** Word Frequency - 108 *****

a

***** Word Frequency - 80 *****

to

***** Word Frequency - 73 *****

health

***** Word Frequency - 71 *****

safety

***** Word Frequency - 63 *****

c is there

***** Word Frequency - 62 *****

b

***** Word Frequency - 60 *****

in

***** Word Frequency - 58 *****

d

***** Word Frequency - 55 *****

all

***** Word Frequency - 50 *****

appropriate

***** Word Frequency - 45 *****

have or

***** Word Frequency - 40 *****

with

***** Word Frequency - 39 *****

arrangements

***** Word Frequency - 37 *****

e equipment

***** Word Frequency - 34 *****

work

***** Word Frequency - 33 *****

f

***** Word Frequency - 30 *****

employees

***** Word Frequency - 29 *****

your

***** Word Frequency - 28 *****

on

***** Word Frequency - 26 *****

that

***** Word Frequency - 24 *****

area hazard requirements

***** Word Frequency - 23 *****

other you

***** Word Frequency - 22 *****

defined do g
their

***** Word Frequency - 21 *****

policy safe

***** Word Frequency - 19 *****

systems training

***** Word Frequency - 18 *****

as necessary protective
which

***** Word Frequency - 17 *****

any personal s
where

***** Word Frequency - 16 *****

energy responsibility use

***** Word Frequency - 15 *****

by does ensuring
h hazards identified
relevant statutory substances

***** Word Frequency - 14 *****

adequate maintenance out
personnel these tools

***** Word Frequency - 13 *****

been from monitoring
procedures

***** Word Frequency - 12 *****

action an if
new plant trained

***** Word Frequency - 11 *****

be ensure i
organisation provided results
those used within
workplace

***** Word Frequency - 10 *****

fire including information
made regulations responsible
sources taken written

***** Word Frequency - 9 *****

applicable apply changes
clearly facing j
list page this

***** Word Frequency - 8 *****

at aware before
carried control guards
involved its kept
machinery nature register
tasks they vehicles

***** Word Frequency - 7 *****

blank case continue
emergency facilities formal
identify legislation objectives
sheets special storage
surveys

***** Word Frequency - 6 *****

assessing associated basis
drivers employee given
informed inventory might
not only performance
reporting representatives
responsibilities
routine standards

***** Word Frequency - 5 *****

access activities analyses
assessment can carrying
change controlling correct
current designed extent
first fittings fixtures
guard hazardous inspections
into major measures
medical people recommendations

regularly risks skills
task techniques than
vehicle when

***** Word Frequency - 4 *****

account analysed analysis
answer audience authorised
available away checked
chemicals clothing contractors
days description e.g.
effects every examinations
existing fixed flammable
following high how
identifying include injury
it k known
legal management meet
more need outside
persons potential practices
procedure received records
resources reviewed section
supervision up-to-date using
who working yes

***** Word Frequency - 3 *****

affect allocated answered
areas arising below
best but checks
chemical clear computer
consequences controls copy
damage design detailed
devices disposal e.
each effectiveness etc
explosive gas implications
informing inspection interlock
job know l
listed location m
maintained marked n
needs occupational permit-to-work
person points possible
practice questions reviewing
risk screening specific
start surveillance survey
take them time
types wear

***** Word Frequency - 2 *****

about accident adequately
adjustable advisory affected
aid aider air
appointed assessed automatic
became being boilers
boxes built cannot
check codes commit
committee communication comply
condition conditions contain
containers contents controlled
conveniently conversion cover
covered criteria dangerous
date descriptions designated
devising distribution down
drills drive during
easily effectively either
enable engineer explosion
exposure failure faults
feedback financial fitted
followed free fuel
guarding hand has
hygiene implemented incident
incidents includes individual
intervals inventories investigation

investigations involving irritants
 issued issues keeping
 laid last less
 level levels likely
 loading lpg machine
 manufacture materials means
 mechanisms members messages
 miss near newly
 no o obtained
 occurrence occurrences operate
 own p part
 passing pedestrians power
 process processes proposed
 qualified ready receive
 recognised recorded regular
 repair required revised
 rewards road routes
 safeguard scheduled significant
 space specifically specified
 store stored suitable
 supplied team toxic
 trip undertaken undesirable
 unloading ventilation wastes
 ways would year

***** Word Frequency - 1 *****

accordance accurate acetylides
 act actions active
 adequacy adjustment adopted
 advice adviser affecting
 afterwards agents agree
 agreed aiders alarm
 allowed along also
 amounts analysing annual
 applied applying appropriateness
 approved arrangement aspects
 assess assessments atmospheric
 attention audit auditing
 authority back based
 beginning believe benefit
 between board bolts
 box breakdowns brought
 by-products cables carcinogens
 career carry categories
 cater causes central
 centre certificate chemist
 chimneys circumstances cleaning
 co-ordinating collated commitment
 committed committees communicated
 complaints compliance components
 compressed compressors concerned
 conducting conflicts conform
 conjunction consolidation construction
 consultant consultation contact
 contingency continues continuing
 continuous cope copies
 corrosion covering covers
 create creation cross-section
 crossing cylinders daily
 damaged danger data
 dc deal dealing
 dealt decisions declare
 designing detail details
 detection detectors deterioration
 detonators development deviate
 different dining director
 documents drawn driver
 driving e.g. e.g.
 e.g. e.g. e.g.
 e.g. e.g. e.g.
 e.g. e.g. e.g.
 e.g. e.g. e.g.

e.g. e.g. e.g.
 e.g. e.g. e.g.
 effective egress electrical
 emergencies enclosures enter
 escape estimate evaluation
 even event everyone
 evidence examination exceed
 exchangers executive exemptions
 expenditure experience explain
 explained explosives exposed
 extended extinguishers extinguishing
 extremes fail-to failures
 familiar far fed
 first-aid fit flues
 follow follow-up follows
 fork-lift formally forthcoming
 frequent friction fuels
 full functioning functions
 funding furnaces further
 future gaseous generating
 generators genuine glare
 goods grounds guidance
 handle handled handling
 hardware heat heaters
 her his hours
 housekeeping hsc human
 hygienist i.e. i.e.
 identification identity iee
 ill illnesses implement
 implementation impossible incentives
 induction industrial input
 inside installation instruction
 insurance integrated intermediates
 introducing investigated isolation
 issue items knowledge
 labelled layout learned
 least lifting lifts
 light lighting lines
 liquid liquids literature
 lock-off machines maintain
 making manner manual
 marshalls may mechanism
 meeting meets message
 met method methodology
 methods modes monitor
 monitored months mot
 motor narcotic next
 noise nominated non-legislative
 non-visible normal nuclides
 number nurse objectively
 obligations obtain obtaining
 occur oil one
 open opened operated
 operating operation opportunities
 opportunity options order
 organic organisations others
 ought ovens over
 packaged pan parking
 participation particular parties
 partly parts perceived
 period periodic permanent
 permissible peroxides petroleum
 physician plan planned
 plastic point poisons
 posed position positioned
 positioning post-issue pre
 pre-employment precautions presses
 pressure prevented priority
 produce production products
 professional projects provision
 publications pumps purchase
 purchased purpose qualifications
 radiations radioisotope random
 re-qualified re-stocked re-trained

reaching	readily	reading
real	reasons	reassessments
record	refer	refrigeration
regulators	related	remedial
removal	repaired	repairs
replacements	reported	require
requirement	respect	respond
responding	reversing	review
reviews	revision	reward
rules	running	safest
satisfactory	scratches	screens
screws	second-hand	selecting
selection	senior	separation
served	services	set
shown	side	signed
signs	sited	skid
skin	slings	so
software	someone	spaces
specialised	specialist	standard
still	stops	study
subsequent	such	sufficiently
summary	supplying	support
swamp	system	systemic
tampering	targets	technical
temperature	testing	third
through	toilet	tool
top	towards	trade
traffic	trainees	transparent
transport	transported	transporters
trivial	two	two-way
unacceptable	under	understand
undue	union	unserviceable
up	up-to	updated
us	value	very
vibration	visibility	visiting
visitors	voltage	washroom
waste	way	well
whenever	winter	wiring
without	years	

APPENDIX 3

Database Field Definitions

Field Name	Field Type	Formula / Entry Option
Clarity	Text	Value List: Satisfactory Multiple Question Unclear
Hazard ID 1	Text	Value List: 5.1 incident/accident investigation?
Hazard ID 2	Text	Value List: 5.2 Measurement and/or analysis?
Hazard ID 3	Text	Value List: 5.3 Workplace inspections?
Hazard ID 4	Text	Value List: 5.4 Inventories?
Hazard ID 5	Text	Value List: 5.5 Risk Assessment techniques
Hazard ID 6	Text	Value List: 5.6 Other
Heading	Text	
HS Function 1	Text	Value List: 1.1 policy/plans/objectives
Probing MQ	Text	Value List: all
No of Questions	Number	Auto-enter: "1" Value List: 1
Number of Questions	Summary	= Count of Question order
People 1	Text	Value List: 2.1 Directors/managers?
People 2	Text	Value List: 2.2 Supervisors?
People 3	Text	Value List: 2.3 Employees/operatives?
People 4	Text	Value List: 2.4 Contractors?
People 5	Text	Value List: 2.5 The public (incl. visitors)
People 6	Text	Value List: 2.6 H & S support (incl. medical,first-aid, fire, reps)?
People 7	Text	Value List: 2.7 All other people
People 8	Text	Value List: 2.8 Other
Prescription 1	Text	Value List: Compliance with standard
Prescription 2	Text	Value List: professional judgement
Prescription 3	Text	Value List: written
Prescription 4	Text	Value List: other
Probing 1	Text	Value List: arrangements/procedures
Probing 2	Text	Value List: documents, policies, certificates

Field Name	Field Type	Formula / Entry Option
Probing 3	Text	Value List: frequency
Probing 4	Text	Value List: percentage compliance
Probing 5	Text	Value List: other
Question No.	Number	Unique values only
Question order	Number	Unique values only Only allow values of type: "Number"
Question Score	Text	
Question Text	Text	
Risk Control 10	Text	Value List: 6.10 Health surveillance
Risk Control 11	Text	Value List: 6.11 Amelioration
Risk Control 2	Text	Value List: 6.2 Elimination and Substitution
Risk Control 3	Text	Value List: 6.3 Engineering Controls
Risk Control 4	Text	Value List: 6.4 Facilities (e.g.showers)
Risk Control 5	Text	Value List: 6.5 Special Equipment
Risk Control 6	Text	Value List: 6.6 Safe systems of work (incl. information, instruction, training &supervision)
Risk Control 7	Text	Value List: 6.7 Permits to work
Risk Control 9	Text	Value List: 6.9 PPE
Scoring	Text	Value List: Absolute (all or nothing) Scale Frequency Percentage achievement Professional judgement Verification required
Section	Text	
Specific Topics 1	Text	Value List: 7.1 Energy ?
Specific Topics 2	Text	Value List: 7.2 Confined spaces
Specific Topics 3	Text	Value List: 7.3 Noise and vibration
Specific Topics 4	Text	Value List: 7.4 Visual Display Units
Specific Topics 5	Text	Value List: 7.5 Radiation
Specific Topics 6	Text	Value List: 7.6 Off-the-job safety
Specific Topics 7	Text	Value List: 7.7 Environmental Management
Specific Topics 9	Text	Value List: 7.9 Other
Sub Section	Text	

Field Name	Field Type	Formula / Entry Option
Supporting text:	Text	
Topic No.	Number	
Total Hazard ID 1	Summary	= Count of Hazard ID 1
Total Hazard ID 2	Summary	= Count of Hazard ID 2
Total Hazard ID 3	Summary	= Count of Hazard ID 3
Total Hazard ID 4	Summary	= Count of Hazard ID 4
Total Hazard ID 5	Summary	= Count of Hazard ID 5
Total Hazard ID 6	Summary	= Count of Hazard ID 6
Total Marginal	Summary	= Count of Probing MQ
Total People 1	Summary	= Count of People 1
Total People 2	Summary	= Count of People 2
Total People 3	Summary	= Count of People 3
Total People 4	Summary	= Count of People 4
Total People 5	Summary	= Count of People 5
Total People 6	Summary	= Count of People 6
Total People 7	Summary	= Count of People 7
Total People 8	Summary	= Count of People 8
Total Prescription 1	Summary	= Count of Prescription 1
Total Prescription 2	Summary	= Count of Prescription 3
Total Prescription 3	Summary	= Count of Prescription 2
Total Prescription 4	Summary	= Count of Prescription 4
Total Probing 1	Summary	= Count of Probing 1
Total Probing 2	Summary	= Count of Probing 2
Total Probing 3	Summary	= Count of Probing 3
Total Probing 4	Summary	= Count of Probing 4
Total Probing 5	Summary	= Count of Probing 5
Total Risk Control 10	Summary	= Count of Risk Control 10
Total Risk Control 11	Summary	= Count of Risk Control 11
Total Risk Control 2	Summary	= Count of Risk Control 2
Total Risk Control 3	Summary	= Count of Risk Control 3
Total Risk Control 4	Summary	= Count of Risk Control 4
Total Risk Control 5	Summary	= Count of Risk Control 5
Total Risk Control 6	Summary	= Count of Risk Control 6
Total Risk Control 7	Summary	= Count of Risk Control 7
Total Risk Control 9	Summary	= Count of Risk Control 9
Total Topics 1	Summary	= Count of Specific Topics 1
Total Topics 2	Summary	= Count of Specific Topics 2
Total Topics 3	Summary	= Count of Specific Topics 3
Total Topics 4	Summary	= Count of Specific Topics 4
Total Topics 5	Summary	= Count of Specific Topics 5
Total Topics 6	Summary	= Count of Specific Topics 6
Total Topics 7	Summary	= Count of Specific Topics 7
Total Topics 9	Summary	= Count of Specific Topics 9
Total Work Activities 9	Summary	= Count of Work Activities 9
Total Workplace 1	Summary	= Count of Workplace 1
Total Workplace 2	Summary	= Count of Workplace 2
Total Workplace 3	Summary	= Count of Workplace 3
Total Workplace 4	Summary	= Count of Workplace 4
Total Workplace 5	Summary	= Count of Workplace 5

Field Name	Field Type	Formula / Entry Option
Total Workplace 6	Summary	= Count of Workplace 6
Total Workplace 7	Summary	= Count of Workplace 7
Total Workplace 8	Summary	= Count of Workplace 8
Total Workplace 9	Summary	= Count of Workplace 9
Work activities 1	Text	Value List: 4.1 Work activities/tasks (gen)
Work activities 2	Text	Value List: 4.2 Designing and/or planning?
Work activities 3	Text	Value List: 4.3 Construct, install, demolish?
Work activities 4	Text	Value List: 4.4 change
Work activities 5	Text	Value List: 4.5 Maintenance, repair, cleaning?
Work activities 6	Text	Value List: 4.6 Materials etc. handling?
Work activities 7	Text	Value List: 4.7 Use of substances hazardous to health?
Work Activities 8	Text	Value List: 4.8 Supply of products and services
Work Activities 9	Text	Value List: 4.9 Other
Workplace 1	Text	Value List: 3.1 access, egress
Workplace 2	Text	Value List: 3.2 Fixed plant and/or machinery?
Workplace 3	Text	Value List: 3.3 Transport?
Workplace 4	Text	Value List: 3.4 toilets, washrooms?
Workplace 5	Text	Value List: 3.5 Storage facilities?
Workplace 6	Text	Value List: 3.6 heating/lighting
Workplace 7	Text	Value List: 3.7 housekeeping
Workplace 8	Text	Value List: 3.8 posters, notice boards
Workplace 9	Text	Value List: 3.9 Other
Specific Topics 8	Text	Value List: 7.8 Tools and equipment
Total Topics 8	Summary	= Count of Specific Topics 8
Total Work Activities 8	Summary	= Count of Work Activities 8
Total Work Activities 7	Summary	= Count of Work activities 7
Total Work Activities 6	Summary	= Count of Work activities 6
Total Work Activities 5	Summary	= Count of Work activities 5
Total Work Activities 4	Summary	= Count of Work activities 4

Field Name	Field Type	Formula / Entry Option
Total Work Activities 3	Summary	= Count of Work activities 3
Total Work Activities 2	Summary	= Count of Work activities 2
Total Work Activities 1	Summary	= Count of Work activities 1
Risk Control 8	Text	Value List: 6.8 Selection and training
Total Risk Control 8	Summary	= Count of Risk Control 8
Risk Control 12	Text	Value List: 6.12 other
Total Risk Control 12	Summary	= Count of Risk Control 12
Risk Control 1	Text	Value List: 6.1 Risk control implementation
Total Risk Control 1	Summary	= Count of Risk Control 1
Total HS Function 1	Summary	= Count of HS Function 1
HS Function 2	Text	Value List: 1.2 communication/consultation
HS Function 3	Text	Value List: 1.3 responsibilities/duties
HS Function 4	Text	Value List: 1.4 Commitment/involvement/promotion
HS Function 5	Text	Value List: 1.5 compliance
HS Function 6	Text	Value List: 1.6 auditing
HS Function 7	Text	Value List: 1.7 resources
HS Function 8	Text	Value List: 1.8 other
Total HS Function 2	Summary	= Count of HS Function 2
Total HS Function 3	Summary	= Count of HS Function 3
Total HS Function 4	Summary	= Count of HS Function 4
Total HS Function 5	Summary	= Count of HS Function 5
Total HS Function 6	Summary	= Count of HS Function 6
Total HS Function 7	Summary	= Count of HS Function 7
Total HS Function 8	Summary	= Count of HS Function 8

APPENDIX 5

Database Categorisation Results CHASE II version 4.1

Evaluation of Questions CHASE
(No. of records 369)

Prescription

<input type="checkbox"/> Compliance with standard	16
<input type="checkbox"/> professional judgement	169
<input type="checkbox"/> written	9
<input type="checkbox"/> other	187

Probing

<input type="checkbox"/> arrangements/procedures	106
<input type="checkbox"/> documents, policies, certificates	50
<input type="checkbox"/> frequency	3
<input type="checkbox"/> percentage compliance	0
<input type="checkbox"/> all	73
<input type="checkbox"/> other	168

HS Organisation and functions

<input type="checkbox"/> 1.1 policy/plans/objectives	52
<input type="checkbox"/> 1.2 communication/consultation	33
<input type="checkbox"/> 1.3 responsibilities/duties	45
<input type="checkbox"/> 1.4 Commitment/involvement/promotion	5
<input type="checkbox"/> 1.5 compliance	16
<input type="checkbox"/> 1.6 auditing	36
<input type="checkbox"/> 1.7 resources	15
<input type="checkbox"/> 1.8 other	205

People

<input type="checkbox"/> 2.1 Directors/managers?	6
<input type="checkbox"/> 2.2 Supervisors?	6
<input type="checkbox"/> 2.3 Employees/operatives?	43
<input type="checkbox"/> 2.4 Contractors?	4
<input type="checkbox"/> 2.5 The public (incl. visitors)	2
<input type="checkbox"/> 2.6 H & S support (incl. medical, first-aid, fire, reps)	8
<input type="checkbox"/> 2.7 All other people	0
<input type="checkbox"/> 2.8 Other	308

Workplace 1

<input type="checkbox"/> 3.1 access, egress	7
<input type="checkbox"/> 3.2 Fixed plant and/or machinery?	19
<input type="checkbox"/> 3.3 Transport?	13
<input type="checkbox"/> 3.4 toilets, washrooms?	2
<input type="checkbox"/> 3.5 Storage facilities?	11
<input type="checkbox"/> 3.6 heating/lighting	0
<input type="checkbox"/> 3.7 housekeeping	1
<input type="checkbox"/> 3.8 posters, notice boards	0
<input type="checkbox"/> 3.9 Other	320

Evaluation of Questions CHASE
(No. of records 369)

Work activities

<input type="checkbox"/> 4.1 Work activities/tasks (gen)	12
<input type="checkbox"/> 4.2 Designing and/or planning?	0
<input type="checkbox"/> 4.3 Construct, install, demolish?	1
<input type="checkbox"/> 4.4 change	22
<input type="checkbox"/> 4.5 Maintenance, repair, cleaning?	28
<input type="checkbox"/> 4.6 Materials etc. handling?	1
<input type="checkbox"/> 4.7 Use of substances hazardous to health?	19
<input type="checkbox"/> 4.8 Supply of products and services	0
<input type="checkbox"/> 4.9 Other	288

Hazard ID 1

<input type="checkbox"/> 5.1 incident/accident investigation?	25
<input type="checkbox"/> 5.2 Measurement and/or analysis?	37
<input type="checkbox"/> 5.3 Workplace inspections?	32
<input type="checkbox"/> 5.4 Inventories?	4
<input type="checkbox"/> 5.5 Risk Assessment techniques	6
<input type="checkbox"/> 5.6 Other	270

Risk Control

<input type="checkbox"/> 6.1 Risk control implementation	5
<input type="checkbox"/> 6.2 Elimination and Substitution	1
<input type="checkbox"/> 6.3 Engineering Controls	18
<input type="checkbox"/> 6.4 Facilities (e.g. showers)	1
<input type="checkbox"/> 6.5 Special Equipment	5
<input type="checkbox"/> 6.6 Safe systems of work (incl. information, instruct	18
<input type="checkbox"/> 6.7 Permits to work	4
<input type="checkbox"/> 6.8 Selection and training	38
<input type="checkbox"/> 6.9 PPE	16
<input type="checkbox"/> 6.10 Health surveillance	8
<input type="checkbox"/> 6.11 Amelioration	25
<input type="checkbox"/> 6.12 other	245

Specific Topics 1

<input type="checkbox"/> 7.1 Energy ?	26
<input type="checkbox"/> 7.2 Confined spaces	0
<input type="checkbox"/> 7.3 Noise and vibration	1
<input type="checkbox"/> 7.4 Visual Display Units	0
<input type="checkbox"/> 7.5 Radiation	1
<input type="checkbox"/> 7.6 Off-the-job safety	0
<input type="checkbox"/> 7.7 Environmental Management	3
<input type="checkbox"/> 7.8 Tools and equipment	13
<input type="checkbox"/> 7.9 Other	329

APPENDIX 6

Database Categorisation Results ISRS fifth edition

Evaluation of Questions ISRS
(No. of records 576)

Prescription

<input type="checkbox"/> Compliance with standard	68
<input type="checkbox"/> professional judgement	99
<input type="checkbox"/> written	45
<input type="checkbox"/> other	413

Probing

<input type="checkbox"/> arrangements/procedures	73
<input type="checkbox"/> documents, policies, certificates	36
<input type="checkbox"/> frequency	52
<input type="checkbox"/> percentage compliance	51
<input type="checkbox"/> all	81
<input type="checkbox"/> other	327

HS Organisation and functions

<input type="checkbox"/> 1.1 policy/plans/objectives	75
<input type="checkbox"/> 1.2 communication/consultation	72
<input type="checkbox"/> 1.3 responsibilities/duties	33
<input type="checkbox"/> 1.4 Commitment/involvement/promotion	22
<input type="checkbox"/> 1.5 compliance	68
<input type="checkbox"/> 1.6 auditing	137
<input type="checkbox"/> 1.7 resources	14
<input type="checkbox"/> 1.8 other	262

People

<input type="checkbox"/> 2.1 Directors/managers?	118
<input type="checkbox"/> 2.2 Supervisors?	28
<input type="checkbox"/> 2.3 Employees/operatives?	99
<input type="checkbox"/> 2.4 Contractors?	8
<input type="checkbox"/> 2.5 The public (incl. visitors)	4
<input type="checkbox"/> 2.6 H & S support (incl. medical, first-aid, fire, reps)	9
<input type="checkbox"/> 2.7 All other people	2
<input type="checkbox"/> 2.8 Other	335

Workplace 1

<input type="checkbox"/> 3.1 access, egress	1
<input type="checkbox"/> 3.2 Fixed plant and/or machinery?	6
<input type="checkbox"/> 3.3 Transport?	1
<input type="checkbox"/> 3.4 toilets, washrooms?	0
<input type="checkbox"/> 3.5 Storage facilities?	8
<input type="checkbox"/> 3.6 heating/lighting	0
<input type="checkbox"/> 3.7 housekeeping	6
<input type="checkbox"/> 3.8 posters, notice boards	13
<input type="checkbox"/> 3.9 Other	544

Evaluation of Questions ISRS
(No. of records 576)

Work activities

<input type="checkbox"/> 4.1 Work activities/tasks (gen)	60
<input type="checkbox"/> 4.2 Designing and/or planning?	9
<input type="checkbox"/> 4.3 Construct, install, demolish?	3
<input type="checkbox"/> 4.4 change	15
<input type="checkbox"/> 4.5 Maintenance, repair, cleaning?	17
<input type="checkbox"/> 4.6 Materials etc. handling?	4
<input type="checkbox"/> 4.7 Use of substances hazardous to health?	29
<input type="checkbox"/> 4.8 Supply of products and services	1
<input type="checkbox"/> 4.9 Other	449

Hazard ID 1

<input type="checkbox"/> 5.1 incident/accident investigation?	55
<input type="checkbox"/> 5.2 Measurement and/or analysis?	19
<input type="checkbox"/> 5.3 Workplace inspections?	40
<input type="checkbox"/> 5.4 Inventories?	7
<input type="checkbox"/> 5.5 Risk Assessment techniques	1
<input type="checkbox"/> 5.6 Other	465

Risk Control

<input type="checkbox"/> 6.1 Risk control implementation	5
<input type="checkbox"/> 6.2 Elimination and Substitution	0
<input type="checkbox"/> 6.3 Engineering Controls	3
<input type="checkbox"/> 6.4 Facilities (e.g. showers)	0
<input type="checkbox"/> 6.5 Special Equipment	8
<input type="checkbox"/> 6.6 Safe systems of work (incl. information, instruct	35
<input type="checkbox"/> 6.7 Permits to work	4
<input type="checkbox"/> 6.8 Selection and training	66
<input type="checkbox"/> 6.9 PPE	27
<input type="checkbox"/> 6.10 Health surveillance	6
<input type="checkbox"/> 6.11 Amelioration	68
<input type="checkbox"/> 6.12 other	389

Specific Topics 1

<input type="checkbox"/> 7.1 Energy ?	4
<input type="checkbox"/> 7.2 Confined spaces	2
<input type="checkbox"/> 7.3 Noise and vibration	1
<input type="checkbox"/> 7.4 Visual Display Units	0
<input type="checkbox"/> 7.5 Radiation	1
<input type="checkbox"/> 7.6 Off-the-job safety	19
<input type="checkbox"/> 7.7 Environmental Management	10
<input type="checkbox"/> 7.8 Tools and equipment	0
<input type="checkbox"/> 7.9 Other	546

APPENDIX 7

Database Categorisation Results QSA

Evaluation of Questions QSA
(No. of records 672)

Prescription

<input type="checkbox"/> Compliance with standard	28
<input type="checkbox"/> professional judgement	38
<input type="checkbox"/> written	32
<input type="checkbox"/> other	615

Probing

<input type="checkbox"/> arrangements/procedures	122
<input type="checkbox"/> documents, policies, certificates	109
<input type="checkbox"/> frequency	42
<input type="checkbox"/> percentage compliance	23
<input type="checkbox"/> all	67
<input type="checkbox"/> other	382

HS Organisation and functions

<input type="checkbox"/> 1.1 policy/plans/objectives	98
<input type="checkbox"/> 1.2 communication/consultation	50
<input type="checkbox"/> 1.3 responsibilities/duties	47
<input type="checkbox"/> 1.4 Commitment/imvolvement/promotion	26
<input type="checkbox"/> 1.5 compliance	30
<input type="checkbox"/> 1.6 auditing	121
<input type="checkbox"/> 1.7 resources	23
<input type="checkbox"/> 1.8 other	356

People

<input type="checkbox"/> 2.1 Directors/managers?	40
<input type="checkbox"/> 2.2 Supervisors?	29
<input type="checkbox"/> 2.3 Employees/operatives?	123
<input type="checkbox"/> 2.4 Contractors?	17
<input type="checkbox"/> 2.5 The public (incl. visitors)	8
<input type="checkbox"/> 2.6 H & S support (incl. medical,first-aid, fire, reps)	26
<input type="checkbox"/> 2.7 All other people	20
<input type="checkbox"/> 2.8 Other	474

Workplace 1

<input type="checkbox"/> 3.1 access, egress	0
<input type="checkbox"/> 3.2 Fixed plant and/or machinery?	6
<input type="checkbox"/> 3.3 Transport?	0
<input type="checkbox"/> 3.4 toilets, washrooms?	0
<input type="checkbox"/> 3.5 Storage facilities?	1
<input type="checkbox"/> 3.6 heating/lighting	0
<input type="checkbox"/> 3.7 housekeeping	0
<input type="checkbox"/> 3.8 posters,notice boards	4
<input type="checkbox"/> 3.9 Other	661

Evaluation of Questions QSA
(No. of records 672)

Work activities

<input type="checkbox"/> 4.1 Work activities/tasks (gen)	14
<input type="checkbox"/> 4.2 Designing and/or planning?	2
<input type="checkbox"/> 4.3 Construct, install, demolish?	4
<input type="checkbox"/> 4.4 change	6
<input type="checkbox"/> 4.5 Maintenance, repair, cleaning?	5
<input type="checkbox"/> 4.6 Materials etc. handling?	11
<input type="checkbox"/> 4.7 Use of substances hazardous to health?	23
<input type="checkbox"/> 4.8 Supply of products and services	4
<input type="checkbox"/> 4.9 Other	608

Hazard ID 1

<input type="checkbox"/> 5.1 incident/accident investigation?	64
<input type="checkbox"/> 5.2 Measurement and/or analysis?	33
<input type="checkbox"/> 5.3 Workplace inspections?	32
<input type="checkbox"/> 5.4 Inventories?	8
<input type="checkbox"/> 5.5 Risk Assessment techniques	49
<input type="checkbox"/> 5.6 Other	499

Risk Control

<input type="checkbox"/> 6.1 Risk control implementation	23
<input type="checkbox"/> 6.2 Elimination and Substitution	1
<input type="checkbox"/> 6.3 Engineering Controls	8
<input type="checkbox"/> 6.4 Facilities (e.g.showers)	0
<input type="checkbox"/> 6.5 Special Equipment	2
<input type="checkbox"/> 6.6 Safe systems of work (incl. information, instruct	32
<input type="checkbox"/> 6.7 Permits to work	1
<input type="checkbox"/> 6.8 Selection and training	76
<input type="checkbox"/> 6.9 PPE	5
<input type="checkbox"/> 6.10 Health surveillance	19
<input type="checkbox"/> 6.11 Amelioration	24
<input type="checkbox"/> 6.12 other	504

Specific Topics 1

<input type="checkbox"/> 7.1 Energy ?	9
<input type="checkbox"/> 7.2 Confined spaces	0
<input type="checkbox"/> 7.3 Noise and vibration	0
<input type="checkbox"/> 7.4 Visual Display Units	7
<input type="checkbox"/> 7.5 Radiation	0
<input type="checkbox"/> 7.6 Off-the-job safety	6
<input type="checkbox"/> 7.7 Environmental Management	6
<input type="checkbox"/> 7.8 Tools and equipment	0
<input type="checkbox"/> 7.9 Other	644