
INTEGRATION OF SAFETY, HEALTH, ENVIRONMENT AND QUALITY (SHEQ) MANAGEMENT SYSTEM IN CONSTRUCTION: A REVIEW

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Abstract: There are several standard of management systems such as ISO 9001 for Quality Management System, ISO 14001 for Environmental Management System, and OHSAS 18001 for Safety and Health Management System. These management systems are often treated as independent functions within organizations. However, many professionals belief that it is possible to harmonise ISO 9001 QMS, ISO 14001 EMS and OHSAS 18001 OHSMS. The objectives of this study are to review the existing management standards on health and safety, environmental and quality; to study the correspondences data between these three management systems; to develop guidelines of SHEQ Integrated Management System; and to study the advantages and disadvantages of the proposed guidelines. The corresponding elements between those three management systems seem to be compatible and the possibility of integrating them is feasible. Finally, the proposed integrated Safety, Health, Environmental and Quality (SHEQ) Management System's guidelines have been developed.

Keywords: *Quality Management System; Environmental Management System; Occupational Safety and Health Management System; Integrated Management System.*

Abstrak: Terdapat beberapa standard sistem pengurusan seperti ISO 9001 untuk Sistem Pengurusan Kualiti, ISO 14001 untuk Sistem Pengurusan Alam Sekitar dan OHSAS 18001 untuk Sistem Pengurusan Keselamatan dan Kesihatan. Malangnya, sistem pengurusan tersebut sering dianggap mempunyai fungsi yang berasingan dalam organisasi. Walau bagaimanapun, ramai profesional percaya akhirnya ISO 9001 QMS, ISO 14001 EMS dan OHSAS 18001 OHSMS patut diharmonikan dalam sesuatu kaedah. Objektif kajian ini adalah untuk mengkaji standard-standard pengurusan yang sedia ada, iaitu kesihatan dan keselamatan, alam sekitar dan kualiti; mengkaji persamaan antara ketiga-tiga standard ini; menghasilkan satu garis panduan bagi Sistem Pengurusan integrasi SHEQ; dan akhir sekali untuk mengkaji kelebihan dan kelemahan garis panduan sistem yang dihasilkan. Didapati wujud persamaan yang ketara antara tiga sistem pengurusan tersebut dan kemungkinan mengintegrasikan mereka adalah tinggi. Akhirnya, satu garis panduan Sistem Integrasi Pengurusan Keselamatan, kesihatan, Alam Sekitar dan Kualiti telah dibangunkan.

Katakunci: *Sistem Pengurusan Kualiti; Sistem Pengurusan Alam Sekitar; Sistem Pengurusan Keselamatan dan Kesihatan; Sistem Pengurusan Integrasi.*

1. Introduction

Malaysia is experiencing global competition, and anyone who work in construction industry has seen the effect. One can no longer afford to have a staff of specialists to address all the things that need to be done. Safety, Health, Environment and Quality are the four cornerstones of a functional management system. As in construction management field, there are several standards of management such as *ISO 9001* for Quality System, *ISO 14001* for Environmental Management System, and *OHSAS 18001* for Safety and Health Management System. The common belief among professionals in the international standards arena is that these systems ultimately should be harmonized in some manner (Ziebell, 1999).

An Integrated Management System (IMS) is a management system, which integrates all components of a business into one coherent system so as to enable the achievement of its purpose and mission (De Oliveira Matias and Coelho, 2002). Anything that has an effect on business results must be part of the management system. Therefore, an IMS should integrate all currently formalized systems focusing on quality, health and safety, environment, personnel, finance, security etc. This means that all the processes and documents that describe them would be integrated.

In this report, the IMS focuses on the integration of these three management systems, and known as *SHEQ* Management System (Safety and Health-Environmental-Quality Management System). The *SHEQ* Management System establishes a single, defined safety and health, environmental and quality management system that integrate requirements into the work planning and execution processes to effectively protect the clients, workers, public, and the environment. *SHEQ* are very technical management fields that apply the discipline of continuous improvement and business know-how to the technical arena by developing a process, or way of doing work, that moves programs through a structured cycle similar to the “plan-do-check-act” cycle (Knode and Abernathy, 2000). The management of *SHEQ* is often treated as independent functions within organizations. Our local construction companies in Malaysia are short of documentation of management system, which can link together all the aspects of safety, health, environmental and quality. In reality, the management of *SHEQ* is intrinsically linked and cannot be isolated from one another without compromising the performance of the whole management system (Shillito, 1995).

SHEQ can be regarded as having four dimensions of a management system. If managers and employees are focus on only one (or some) of these dimensions, then performance of the management system may suffer (Holdsworth, 2003). A project manager must consider *SHEQ* when making decisions, otherwise conflicts and ineffective uses of resources will be the result. There is basis to integrate OHSAS 18001 safety and health, ISO 14001 environmental and ISO 9001 quality

standards to save resources and improve one's responsibilities (Kjellen et al, 1997). The success of integration will depend on cross-training of managers and skilled support groups to maintain the systems.

The importance of this study is to embed quality, environmental, safety and health practices together in the work process and to achieve an outstanding management performance as an integral element of doing the work in the construction field.

2. Methodology

This study reviews the existing management documents and attempt to integrate the following management systems:

- a) Safety and Health Management System (OHSAS 18001:1999)
- b) Environmental Management System (ISO 14001:1996)
- c) Quality Management System (ISO 9001:2000)

The study methods are discussed according to four distinct phases as listed below:

Phase I: Awareness. In the field of construction management, the management system of Safety and Health, Environmental and Quality play an important part for a project to succeed. These three types of managements are recently applied in the construction management field, but more on single management application, or else the integration of either two management systems.

Phase II: Data collection. The scope of the study was confined to three major standards: Occupational Health and Safety Management Systems (OHSAS 18001:1999), Environmental Management Systems (ISO 14001:1996) and Quality Management Systems (ISO 9001:2000).

Phase III: Data correspondences. Correspondence between these three standards was separated into unique requirements and common requirements. The common requirements were listed in the same categories, in table form, to enable a clear comparative work.

Phase IV: Integration. The *OHSAS 18001*, *ISO 14001* and *ISO 9001* standards shared the goal of developing process rather than performance standards. There has been additional effort to harmonize other aspects of the standards. Structure, terminology, and other elements have been addressed so that the standards are at least compatible.

3. Results and Discussion

3.1 Management System

Nowadays many companies utilize several management systems such as *ISO 9001* for quality, *ISO 14001* for environmental and *ISO 18001* for safety and health (Wilkinson, 1998). *ISO 9001* (Figure 1), is a framework for adopting a systematic approach for managing business processes to meet customer requirements (SixSigma, 2000). *ISO 14001* standard is a model for an environmental management system (Figure 2) and focuses on potential environmental impacts of organizational activities and processes such as pollution, hazardous waste, consumption of natural resources and health of employees (Hale, 1997). *OHSAS 18001* on the other hand, is a model for an Occupational Health and Safety Management System (Figure 3) enables an organization to control its occupational health and safety and improve its performance (NSAI, 2001).

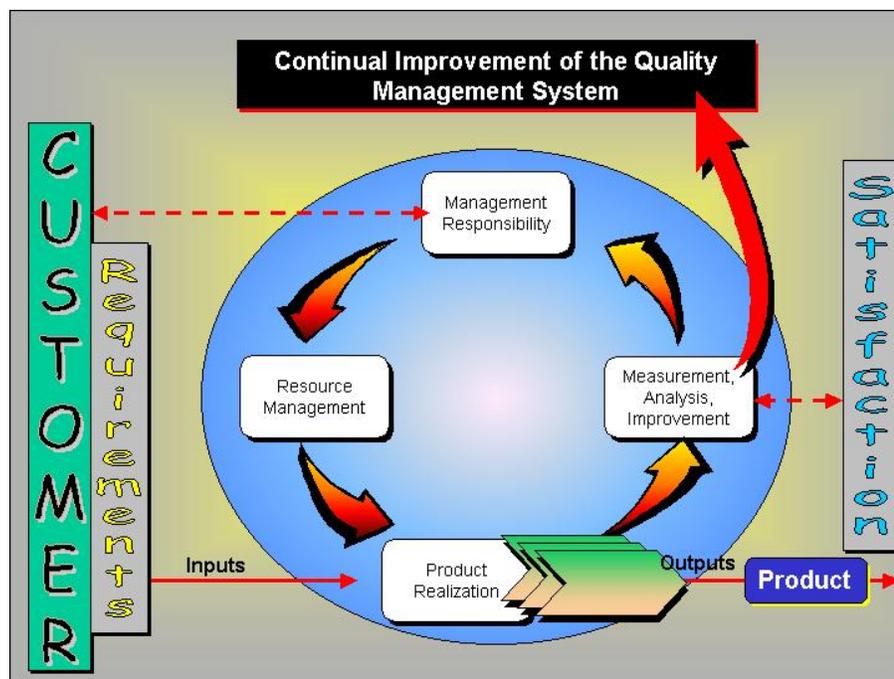


Figure 1: Quality management system model (SixSigma, 2000)

In order to develop an integrated approach to the design and assessment of a management system, the separate management system standards need to have a common structure first (Wilkinson, 1999). Such common criteria allow standards

to be used either separately or collectively, as determined by the company itself. Compatibility between *ISO 9001:2000*, *ISO 14001* and *OHSAS 18001* can be ensured by using a structure based on Deming's 'Plan, Do, Check, Act' (PDCA) management model as shown in Figure 4 (Millidge, 1999). The major difference between those systems is *ISO 9001* makes the customer as the principal stakeholder, whereas *ISO 14001* and *OHSAS 18001* look at the broader stakeholders, i.e. society (Wilkinson, 2000). Currently, both *ISO 14001* and *OHSAS 18001* have six elements arranged in a modified Deming cycle.



Figure 2: Environmental management system model (Hale, 1997)

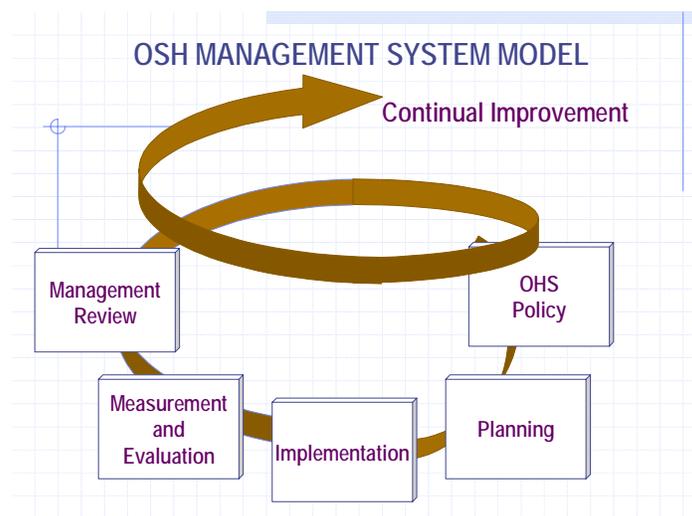


Figure 3: Occupational safety and health management system model (NSAI, 2001)

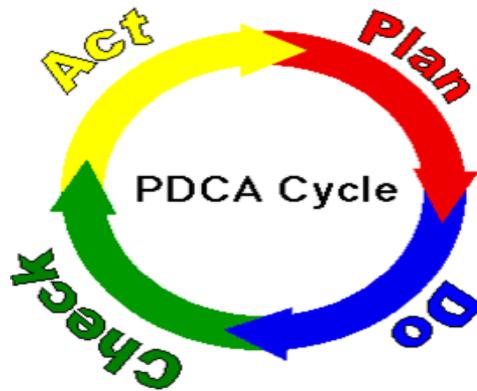


Figure 4: Deming’s Plan-Do-Check-Act cycle (Millidge, 1999).

Table 1: Correspondence between OSHAS 18001, ISO 14001:1996 and ISO 9001:2000

Clause	OSHAS 18001	Clause	ISO 14001:1996	Clause	ISO 9001:2000
1	Scope	1	Scope	1	Scope
2	Reference publications	2	Normative references	2	Normative references
3	Definitions	3	Definitions	3	Definitions
4	OH&S management system elements	4	Environmental management system requirements	4	Quality management system
4.1	General requirements	4.1	General requirements	4.1	General Requirements
4.2	OH&S policy	4.2	Environmental policy	5.3	Quality policy
4.3	Planning	4.3	Planning	5.4	Planning
4.3.1	Planning for hazard identification, risk assessment and risk control	4.3.1	Environment aspect	5.2	Customer focus
4.3.2	Legal and other requirements	4.3.2	Legal and other requirements	5.2	Customer focus
4.3.3	Objectives	4.3.3	Objectives and targets	7.2.1	Determination of requirement related to the product
4.3.4	OH&S management program(s)	4.3.4	Environmental management program(s)	5.4.1	Quality objectives
4.4	Implementation and Operation	4.4	Implementation and Operation	5.4.2	Quality management system planning
				7	Product realization

Table 1: Continue

4.4.1	Structure and responsibility	4.4.1	Structure and responsibility	5 6	Management responsibility Resource management
4.4.2	Training, awareness, and competence	4.4.2	Training, awareness, and competence	6.2.2	Competence, awareness and training
4.4.3	Consultation and communication	4.4.3	Communication	5.2.3	Customer communication
4.4.4	Documentation	4.4.4	Environmental management system documentation	4.2	Documentation Requirements
4.4.5	Document and data control	4.4.5	Document control	4.2.3	Control of documentations
4.4.6	Operational control	4.4.	Operational control	7 7.1 7.2 7.3 7.4 7.5	Product Realization Planning of product realization Customer related processes Design and development Purchasing Production and service provision
4.4.7	Emergency preparedness and response	4.4.7	Emergency preparedness and response	8.3	Control of nonconforming product
4.5	Checking and corrective action	4.5	Checking and Corrective Action	8	Measurement analysis and improvement
4.5.1	Performance measurement and monitoring	4.5.1	Monitoring and measurement	7.6 8.2	Control of monitoring and measuring devices Monitoring and measurement
4.5.2	Accidents, incidents non-conformance and corrective and preventive action	4.5.2	Nonconformance and corrective and preventive action	8.3 8.5.2 8.5.3	Control of non-conforming product Corrective action Preventive action
4.5.3	Records and records management	4.5.3	Records	4.2.4	Control of records
4.5.4	Audit	4.5.4	Environmental management system audit	8.2.2	Internal audits
4.6	Management Review	4.6	Management Review	5.6	Management review

The PDCA model forms the basis of the core structure of these system standards, ensuring compatibility between their requirements in all areas of management system principles. Thus, an integrated system that combines the three standards into one common management system is feasible (Table 1).

3.2 Guidelines of SHEQ Management System

The model for a *SHEQ* management system has six main elements that make up a cycle of continual improvement using PDCA concept as shown in Figure 5 and listed below (Yang, 2002):

SHEQ Policy. An organization defines its *SHEQ* policy and ensures commitment to it. Top management must commit to continual improvement of the *SHEQ* management system, prevention of pollution and compliance with applicable regulation. The *SHEQ* policy must be relevant to the nature, scale, products and services. The policy must be documented, make available to the public and communicated to employees.

Planning. An organization formulates a plan to fulfill its *SHEQ* policy. During this planning phase, the organization develops a cross-functional team and identifies significant *SHEQ* impacts of activities, products, and services along with legal and other standards to which the organization subscribes. It then sets objectives and quantifies them wherever practicable.

Implementation and Operation. The third step is to put the plan into action by providing resources and support mechanisms necessary to achieve the *SHEQ* policy, the objectives and targets. At this stage, the organization defines the roles and responsibilities of all involved in the process, including senior management representatives. It identifies and provides necessary resources, establishes training procedures and implements the internal and external communications procedures.

Checking and Corrective Action. The organization measures, monitors, and evaluates its *SHEQ* performances against its objectives and targets. It monitors and measures processes on a regular basis and tracks performance and conformance with objectives and targets. The organization conducts audits of the *SHEQ* management system to identify areas that require improvement and nonconformance that must be corrected.

Management Review. The final step is to develop procedures to review and continually improve the *SHEQ* management system, with the objective of improving its overall *SHEQ* performance. The organization compares actual performance with its objectives and targets, then identifies and corrects the root causes of deficiencies. It also identifies further opportunities for improvement.

Continual Improvement. All of the above elements are subjected to continuous improvement which is a process of enhancing the *SHEQ* management system, to

achieve improvements in overall *SHEQ* performances, in line with the organization's *SHEQ* policy.

SHEQ-MS Model



Figure 5: Integrated Safety, Health, Environmental and Quality (SHEQ) management system Model (Yang, 2002)

Table 2: Contents of Documentation of SHEQ Management System in Construction

Content	
0	Introduction
1	Scope
2	Reference publications
3	Terms and definitions
4	SHEQ management system elements
4.1	General requirements
4.2	SHEQ policy
4.3	Planning
4.3.1	General Planning
4.3.2	Legal and Other Requirements
4.3.3	Objectives and Targets
4.3.4	SHEQ Management Program
4.4	Implementation and operation
4.4.1	Structure and Responsibility
4.4.2	Training, Awareness and Competence
4.4.3	Consultation, Communication and Reporting
4.4.4	SHEQ Management System Documentation
4.4.5	Documentation and Data Control
4.4.6	Operation Control
4.4.7	Emergency Preparedness and Response
4.5	Checking and corrective action
4.5.1	Performance Measurement, Monitoring, Inspection and Testing
4.5.2	Accidents, Incidents, Non-conformances and Corrective and Preventive
4.5.3	Records and Record Management
4.5.4	Audits
4.6	Management review
	Bibliography

As a result, Guidelines of *SHEQ* Management System in Construction is developed. The brief contents are presented in Table 2. The six major elements' requirements in the *SHEQ* management system guidelines are shown below (Yang, 2002):

- a) Clause 4.1: *General requirements*. The organization shall establish and maintain a *SHEQ* management system, the requirements for which are set out in clause 4, and continuously improve its effectiveness. This should also assist the organization in meeting applicable legal or other *SHEQ* regulation. The organization shall identify the processes needed for the *SHEQ* management system and their application throughout the organization, determine the sequence and interaction of these processes, determine criteria and methods needed to ensure that both the operation and control of these processes are effective, ensure the availability of resources and information necessary to support the operation and monitoring of these processes, monitor, measure and analyze these processes and implement actions necessary to achieve planned results and continual improvement of these processes. These processes shall be managed by the organization in accordance with the requirements of this management system. The organization has the freedom and flexibility to define its boundaries, and may choose to implement *SHEQ* management system with respect to the entire organization, or to specific operating units or activities of the organization.
- b) Clause 4.2: *SHEQ policy*. The *SHEQ* policy is a statement by the organization of its intentions and principles, in relation to its overall *SHEQ* performance, which provides a framework for action and for the setting of its *SHEQ* objectives and targets. A *SHEQ* policy can be based on guiding principle, and tailored to fit an individual organization. The policy should apply to that organization's activities, products, and services. It should reflect the organization's mission and values, and should show commitment, leadership, and direction for the organization's *SHEQ* initiative. The *SHEQ* policy that is authorized by the organization's top management is established to state the overall *SHEQ* objectives and a commitment to improving *SHEQ* performance. The *SHEQ* policy must be appropriate to operation, contain a commitment to continuous improvement, ensure and affirm compliance with regulations, establish a framework of setting objectives, be documented, implemented, and communicated to all employees and be available to the public.
- c) Clause 4.3: *Planning*. The organization shall establish and maintain procedures for the ongoing identification of hazards, the assessment of risks, and the implementation of necessary control measures. These shall include routine and non-routine activities, activities of all personnel having access to the workplace (including subcontractors and visitors) and facilities at the

workplace, whether provided by the organization or others. Planning must identify all *SHEQ* impacts of operations, identify all legal and other requirements, set objectives and targets, and assign responsibility and a time frame for the *SHEQ* management program.

d) Clause 4.4: *Implementation and operation*. The roles, responsibilities, authorities and the interrelation of all personnel who manage, perform and verify works associated with the *SHEQ* risk on the organization's activities, facilities and processes, shall be defined, documented and communicated; particularly for personnel who need the organizational freedom and authority. Ultimate responsibility for *SHEQ* management rests with top management. The organization shall appoint a member of top management with particular responsibility for ensuring that the *SHEQ* management system is properly implemented and performing to requirements in all locations and spheres of operation within the organization. The organization must give authority, resources, and provides structure and responsibility, training, awareness, competence, establish communication (internal and external), provision for documentation and document control, establish operational control (procedures) and emergency preparedness.

e) Clause 4.5: *Checking and corrective action*. The organization shall establish and maintain documented procedures to monitor and measure, on a regular basis, the key characteristics of its operations and activities that can have a significant impact on the *SHEQ*. This shall include the recording of information to track performance, relevant operational controls and conformances with the organization's objectives and targets. The organization must perform monitoring and measurement, address nonconformance and corrective and preventive actions, keep records and carry out *SHEQ* system audit.

f) Clause 4.6: *Management review*. The final component of *SHEQ* management standard parallels the final stage of the cycle. The organization's top management shall, at intervals that it determines, review the *SHEQ* management system, to ensure its continuing suitability, adequacy and effectiveness. The management review process shall ensure that the necessary information is collected to allow management to carry out this evaluation. This review shall be documented. The management review shall address the possible need for changes to policy, objectives and elements of the *SHEQ* management system, in the light of *SHEQ* management system audit results, changing circumstances and the commitment for continual improvement.

3.3 Advantages and Disadvantages of the Integrated Management Systems

Integrated Management Systems lead to several advantages such as (McDonald et al, 2003; Fresner et al, 2004):

- a) Effectiveness of management system. Increase the effectiveness of management system by utilizing the synergies incorporated in SHEQ system such as setting policies, planning, training, inspecting, monitoring, etc.
- b) Reduce duplication and therefore costs. In these three different management systems, there are several elements that basically similar. The integrated management can therefore minimize the duplicative works in order to achieve an optimum working productivity and profitability. For example, one assessment is used to evaluate the SHEQ Management System when previously three audits were required.
- c) Balance conflicting objectives. Each management system has its own goal. Sometimes the conflicts occur when the objectives are crashed one another. The integrated management can coordinate by balancing the objectives and clearly lists down the final aims of the project and the way to achieve it. Conflict reduction between Safety, Health, Environmental and Quality concerns could be achieved by encouraging the organization to consider the implications of changes to the whole system.
- d) Eliminate conflicting responsibilities and relationships. The clusters of automation created a lot of problems in the construction field, especially when the responsibilities and relationships are not clear. The situation becomes worst when two or three management systems are applied at the same time and without a systematic coordination. In this case, an integrated management can eliminate the conflicts of responsibilities and relationships.
- e) Formalize systems. Formalization of the systems brings an effective internal benchmarking between separate Safety, Health, Environment and Quality disciplines besides creating consistencies amongst parties involved.

However, several disadvantages of integration are also highlighted (De Oliveira Martias and Coelho, 2002):

- a) Some major differences between each management standard could impede total correspondence. For instance, while quality standards would affect an organization and its clients, environmental standards have a greater reach that would affect an organization's relationship to its neighbourhood, whereas health and safety standard would protect the workers at site from accidents.
- b) Another disadvantage is that some elements of good safety programs have to be 'forced' to fit into the other two system schemes. *Emergency preparedness*, for example, does not directly correspond to any *ISO* quality standard element without stretching the concept of the standard beyond

recognition. Safety requirements often include behavioral aspects that are not typically addressed in any quality procedure.

4. Conclusions

The study has shown that most of the elements in each standard seem to be in agreement and can be integrated. Quality, environmental, safety and health practices can be incorporated together into a single system that contains those standards. The compatibility of the management principles of *ISO 9001*, *ISO 14001* and *OHSAS 18001* establishes the concept of an Integrated Management System. The advantages for this effort are clear, that are stimulation of business improvement via waste reduction, both in the operation of the processes and management systems, minimizing duplication and reducing barriers between departments and functions. This would eventually add to a company's competitive advantage. However, the merging of the various management systems would reduce the number of specializations and expertise tend to become more generalists.

References

- De Oliveira Matias, J.C. and Coelho, D.A. (2002) The integration of the standards systems of quality management, environmental management and occupational health and safety management. *International Journal of Production Research*, 40(15):3857-3866.
- Fresner, J. and Engelhardt, G. (2004) Experiences with integrated management systems for two small companies in Austria. *Journal of Cleaner Production*, 12(6):623-631.
- Hale, G. (1997) ISO 14000 Integration Tips. [online]. Available. <http://www.qualitydigest.com/feb97/ISO14000.html>. June 14, 2002
- Holdsworth, R. (2003) Practical applications approach to design, development and implementation of an integrated management system. *Journal of Hazardous Materials*, 104(1-3):193-205.
- Kjellen, U., Boe, K. and Hagen, H.L. (1997) Economic effects of implementing internal control of health, safety and environment: A retrospective case study of an aluminium plant. *Safety Science*, 27(2-3):99-114.
- Knode, T.L. and Abernathy, S.E. (2000) Improving performance and managing risk by full integration of HSE and quality into business-delivery processes. *Journal of Petroleum Technology*, 52(9):102-107.
- McDonald, M., Mors, T.A. and Phillips, A. (2003) Management system integration: Can it be done? *Quality Progress*, 36(10):67-74.
- Millidge, C. and Smith, D. (1999) Unifying management systems. *Manufacturing Engineer*, 78(3):98-100.
- NSAI Inc. (2001) OHSAS 18001:1999 Occupational Health and Safety Management Systems – Specification. [online]. Available. <http://www.nsaicert.com/ohas.html>. June 12, 2002.
- Shillito, D.E. (1995) 'Grand unification theory' or should safety, health, environment and quality be managed together or separately? *Process Safety and Environmental Protection*, 73(3):194-202.
- SixSigma LLC (2000) An Introduction to ISO 9000, 9001, 9002, ISO 9000:2000. [online]. Available. <http://www.isixsigma.com/library/content/c000917a.asp>. June 18, 2002.

- Wilkinson, G. and Dale, B.G. (1998) System integration: The views and activities of certification bodies. *TQM Magazine*, 10(4):288-292.
- Wilkinson, G. and Dale, B.G. (1999) Integration management system: An examination of the concept and theory. *TQM Magazine*, 11(2):95-104.
- Wilkinson, G. and Dale, B.G. (2000) Management system standards: The key integration issues. *Proceedings of the Institution of Mechanical Engineers, Part B: Journal of Engineering Manufacture*, 214(9):771-780.
- Yang, A. K. T. (2002) Integration of SHEQ management system in construction field. Master Project Report, Universiti Teknologi Malaysia.
- Ziebell, R. (1999) Unified approach to compliance management. *Proceedings of the 1999 ASQ's 53rd Annual Quality Congress*, Anaheim, CA, USA, 158-165.