Integration of ISO 9001 and ISO 14001: A Study of Common Elements

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Abstract

The purpose of this study was to analyze the elements of ISO 9001:2008 and ISO 14001:2004 standards, identify similarities and differences between them, and propose a methodology for integrating quality management system and environmental management system into a single management system that can be implemented within organizations. A comprehensive literature review regarding the standards, integrated management system, and a qualitative analysis of the clause requirements of both the standard were carried out to derive a conclusion. The result of the study showed that majority of the requirements of both standards were similar and there is a possibility of integrating quality and environmental management system into a single management system. A methodology for implementing integrated management system was developed considering the essential features of both the systems. The proposed road map includes 14 steps of integrated management system implementation and is expected to assist in implementing such system in organizations which may or may not have any existing management system in place. The proposed methodology is simple and is applicable to

organizations of any type, nature and size. Further the implementation methodology is expected to assist in streamlining all the requirements of the management systems and improving overall organizational performance.

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Chapter I: Introduction

Meeting customer demands, complying with statutory and other regulatory requirements and remaining competitive in today's global economy has become a real challenge for every organization. Every organization has its own goal of satisfying a customer's quality needs, demonstrating safety in work place or complying with environmental regulations. In order to achieve the organizational goals, an organization requires a framework of programs and procedures called management system. Management system helps an organization to implement its policy and objectives and to address specific requirement whether it is customer satisfaction or compliance with legal requirements and other requirements. In order to address the customer satisfaction and to increase quality performance of the product or service, organizations adopt quality management system based on ISO 9001 standard whereas to comply with environmental regulations and manage and evaluate environmental aspects, organizations adopt environmental management system based on ISO 14001 standard.

Due to rapid social, political and environmental changes, many organizations have started thinking of different ways to remain competitive. Increasing global temperature, emission of harmful and toxic gases and depleting natural resources have increased awareness in global community for the protection and conservation of environment. This has compelled international community and business organizations to adopt initiatives like sustainable business or green business in order to minimize environmental impacts and remain profitable at the same time. Implementing quality management system and environmental management system within an organization is likely to be quite a strategy towards sustainable business. ISO 9001 and ISO 14001 fulfill the requirement of quality management system and environmental management system respectively. Both of the standards are generic and are equally applicable to service or

manufacturing sector irrespective to the size, type and nature of the organization. Although these standards have different targets and scopes of application, their fundamental structures are similar. Due to basic structural similarities between the two standards, implementation of one management system is possible in an organization that has already implemented another management system or vice versa. Moreover, implementation of environmental management system in an organization that has already implemented quality management system is much easier as quality management system furnishes the basic foundation for implementing any other management system. The similarities in most of the elements of both standards provide a basis of integrating such elements into single unit fulfilling the needs of both the standards.

Statement of the Problem

Implementing two management systems based on different standards within an organization can be expensive, complicated and time consuming process. As there are many common requirements in both standards, implementing separate management systems at a time is likely to result repeated work, increased workloads and redundant documents.

Purpose of the Study

The purpose of this study is to analyze the elements of ISO 9001 and ISO 14001, identify similarities and differences at a system level and propose a methodology for the integration of quality management system and environment management system based on ISO 9001 and ISO 14001 respectively.

Significance of the study

Implementing parallel management systems not only requires additional resources but also makes the process of implementing organizational policy and achieving objectives rather complex. The integration of the ISO 9001 quality management system and ISO 14001

environmental management system will help in potential cost savings by optimizing the resources and effective utilization of time and in improving organizational performance by streamlining documents, simplifying processes, highlighting management problems and ensuring continual improvement. Single system fulfilling the requirements of two different standards will minimize the resources that are required to develop, implement and manage two separate systems. Establishing common procedures for employee training, document control and its management, audits, corrective and preventive actions, and management review require fewer resources and incur less financial burdens. Moreover, single set of work instructions and procedures will help in reducing confusion and effective utilization of personnel.

Definition of Terms

Audit. An examination of results by someone other than the person responsible for producing them so as to verify their accuracy (Hoyle, 2009).

Certification. A process of declaring a product, process, person or organization to have met the specified requirements (Hoyle, 2009).

Continual Improvement. An improvement that happens in recurring occasions rather than in a continuous fashion (BusinessDictionary.com, 2010).

Corrective Action. Identification and elimination causes of a problem so as to prevent their recurrence (BusinessDictionary.com, 2010).

Customer. An entity that dictates the requirement of a process and receives the product of the process from one or more internal or external suppliers (BusinessDictionary.com, 2010).

Defects. Non-conformance of a product with respect to the specified requirements (BusinessDictionary.com, 2010).

Environment. The sum of all factors including culture, demography, economy, politics, regulation, surrounding and physical objects affecting the existence, operation, and growth of an organization (BusinessDictionary.com, 2010).

Environmental Management System (EMS). An organizational structure, planning activities, responsibilities, procedures, processes, resources and standards for formulating, implementing, reviewing and maintaining an organization's policy and achieving its objectives (BusinessDictionary.com, 2010).

International Organization for Standardization (ISO). It is a voluntary, non-treaty federation of standards setting bodies of 130 countries, founded in 1947. With the headquarter in Geneva, it promotes the development of standards and related activities to facilitate international trade in goods and services and cooperates on economic, intellectual, scientific and technological activities (BusinessDictionary.com, 2010).

Management System. A set of interrelated procedures and processes used by an organization in defining and achieving its goals (Hoyle, 2009).

Preventive Action. A proactive approach which is taken as means of preventing something from recurring (Hoyle, 2009)

Process. Sequence of interdependent and linked procedures that use one or more resources to convert inputs into outputs (BusinessDictionary.com, 2010).

Product. The good or service produced as a result of a process that closely meets the requirements of market or an individual (BusinessDictionary.com, 2010).

Quality. A measure of excellence without defects and deficiency that satisfies the specific requirement of a user or customer (BusinessDictionary.com, 2010).

Quality Management System (QMS). Combination of policies, plans, practices and supporting infrastructure used by an organization to reduce and eliminate nonconformities of product, process, service and customer expectation in the most cost effective manner (BusinessDictionary.com, 2010).

Traceability. The ability to trace the history, application, use and location of an item, product or its characteristics by means of recorded data (Hoyle, 2009).

Limitations of the Study

There were several limitations to this research which include company wise study of the integrated management system, comparison between the other management systems that are already in place in the companies, interviews and interaction with the people involved in day to day activities and supplier and consumer perspective. These areas were not addressed due to constraints of resources, time and unavailability of ideal type of companies within reach.

Chapter II: Literature Review

The purpose of this study is to analyze the similarities and differences of quality management system and environmental management systems and highlight on the possibility of their integration into a single management system. This section will include literatures related to the introduction of the management systems, ISO and its standards, benefits to an organization, similarities and differences of the standards and approaches of their integration.

ISO Background

ISO is a short form of International Organization for Standardization, a non-governmental organization with a Central Secretariat located in Geneva, Switzerland (International Organization for Standardization, 2010). ISO was created in 1946 with an aim to facilitate the international coordination and unification of industrial standards and officially started functioning from February, 1947 (Zuckerman, 1997). ISO, a word derived from the Greek "isos" which means equal was chosen as the short form because the name International Organization for Standardization would have resulted in different acronyms in different languages (Von Zharen, 2001). ISO is comprised of 163 national standards bodies, each representing a country and it exists for designing, developing and promoting standards that are acceptable and applicable to every organization in the world (ISO, 2010). According to Von Zharen (2001), ISO exists to facilitate the trade of goods and services by encouraging standardization and related activities all over the globe, and to develop cooperation in science, technology, academic sector and economic activity.

ISO Standards

A standard is a published document with the technical specification or criteria designed to be used as a guideline or rule in order to increase reliability and effectiveness of any product,

service or activity (British Standard Institution, 2010). According to Zuckerman (1997), development of standards result from either market demands, government imposed regulations or any voluntary consensus. ISO explores the interests of producers, consumers, governments, and the scientific community and formulates the international standards through the technical committees by gathering consensus between the member countries (Zuckerman, 1997).

ISO standards serve as technical agreements providing framework for compatible technology and are applicable across the globe. ISO has more than 18000 international standards and related documents that are applicable to various business and service sectors including agriculture, construction, engineering, manufacturing and distribution, transportation, medical and health care, and communication and information (ISO, 2010).

Development of ISO Standards. ISO technical committees (TC) and subcommittees (SC) are involved in the international standard development process that takes place in following six-steps (ISO, 2010):

- Proposal Stage: This is the first stage and at this stage the need for a particular international standard is confirmed and the proposal of its development is presented for approval by the members of relevant Technical Committee (TC) or Sub Committed (SC). The proposal is approved if the majority of the permanent members of the TC/SC agree and at least five permanent members commit to actively participate in the project. The project is led by a project leader.
- Preparatory Stage: This is the second stage and at this stage, a working group of experts from the TC/SC prepare a working draft under the chairmanship of the project leader and prepare several working drafts until the one with best technical solution is finalized. The

draft is then forwarded to the parent committee of the working groups for the consensus-building phase.

- Committee Stage: This is the third stage and at this stage, the first committee draft is registered and then distributed for comments and recommendations by the ISO Central Secretariat. Consensus for the technical content is reached if successive committee drafts are presented and finally the text is finalized as a draft international standard (DIS) for submission.
- Enquiry Stage: This is the fourth stage. Within the period of five months, the draft international standard (DIS) is circulated among all ISO member bodies for comment and approval. It is considered approved if a two-thirds majority of the permanent members of TC/SC cast their vote in favor and not more than one-quarter of the total votes cast are against the draft. The draft is sent back to the originating TC/SC for revision if the approval criteria are not met. Once the draft is approved, it becomes final draft international standard and proceeded for submission.
- Approval Stage: This is the fifth stage. At this stage, the final draft international standard (FDIS) is circulated to all ISO member bodies for final Yes/No vote and this takes place within two months period. The comments received at this stage are not entertained, but are registered for consideration during a future revision. The draft has to be approved by two-thirds majority of the permanent members of TC/SC with not more than one-quarter of the total votes cast in against. In case the draft is not approved, it is sent back to the originating TC/SC for revision.
- Publication Stage: This is the final and the sixth stage. After the approval, the final draft international standard is sent to the ISO Central Secretariat for publication. ISO member

bodies review all international standards at least once after three years of publication and every five years after the first review. The fate of confirmation, revision or withdrawal is decided by the majority of the permanent members of TC/SC.

Benefits of ISO Standards. ISO standards provide technological, societal and economic assistance which are beneficial for innovators, customers, businesses, trade officials, developing countries, general people and the whole planet (ISO, 2010). Some of the benefits of ISO can be highlighted as follows:

- Facilitates in trade between countries
- Helps governments by providing technical support in the sector of health, safety and environmental legislation
- Assists in making the process of product manufacturing, its distribution and other services more efficient, safer, and profitable
- Assists in providing technical guidance and sharing good management practices
- Safeguards consumers and users of products and services
- Assists in providing solutions for common problems
- Disseminates innovation and technological achievements for the welfare of people

Management System

A management system is a proven set of framework that an organization uses for managing and continually improving its policies, programs and processes and achieving its objectives. According to ISO (2010), management system refers to everything that an organization does to manage its processes or activities so that its products or services meet the objective of satisfying the customer's quality needs, complying with regulations, or meeting environmental objectives.

A management system helps an organization to achieve its goals through effective utilization of resources, optimization of process and disciplined management thinking and helps to address the issues related to profitability, competitiveness, globalization, adaptability, technology and growth (BSI, 2010). An effective implementation of a management system helps in managing social, environmental and financial risk, improving operational excellence, reducing cost, increasing customer satisfaction, eliminating trade barriers, fostering innovation, ensuring continual improvement, protecting brand integrity and bringing clarity in the marketplace. Adoption of newer concepts of management by the organizations is guided by increasing global competition and rapidly changing industrial environment (Badreddine, Romdhane, & Amor, 2009).

Management System Standards

Management system standards are general principles that are applicable to any organization whether a business enterprise, a public administration or a government department irrespective of its size, nature and type of product or service it offers. ISO management system standards are based on the operating principles of Plan-Do-Check-Act (PDCA) cycle which provide guidelines in establishing and operating a management system and are as follows (ISO, 2010):

- Plan: This is the first phase of a cycle where requirements of an organization are identified, targets and objectives are established and plans are set up to achieve such targets and objectives.
- Do: This is the execution phase where the developed plans are implemented to achieve the targets and goals.

- Check: This the evaluation phase where actual achievements are monitored, measured and compared against planned objectives and targets.
- Act: In this phase, corrections and improvements are made in the plans when they fail to meet the set objectives and goals. This phase is considered as an opportunity for learning from the mistakes and preparing for improvement in the future. After completing this phase, the cycle again enters plan phase and keeps on continuing.

ISO 9000 Standards

ISO 9000 standards series is the most popular and widely adopted standard representing all international standards relating to quality management systems, released by ISO in 1987 with an aim of assisting organizations in fulfilling the needs of their customers and stakeholders (Zuckerman, 1997). ISO 9000 standards furnish the essence of quality management for an organization which is required for fulfilling its customers' quality needs, meeting applicable regulatory requirements and achieving continual improvement of its performance in the pursuit of its set objectives (Hoyle, 2009). A Technical Committee (TC) 176 named as the International Technical Committee on Quality Assurance and Quality Management was formed by ISO in 1980 and the first ISO 9001 standard was published in 1987. After the first publication in 1987, ISO 9001standard has been revised in 1994, 2000 and 2008 (Hoyle, 2009).

Organizations use ISO 9000 system not only as a foundation for quality management and continual improvement but also as a solid benchmark tool in establishing an internal auditing system and assessing its consistency (Zuckerman, 1997). According to Hoyle (2009), ISO 9000 family of standards includes four international standards for quality management system which specify requirements and recommendations for the design and assessment of management systems and are as follows:

- ISO 9000:2005 - Fundamentals and vocabulary for quality management system
- ISO 9001:2008 - Requirements for quality management system
- ISO 9004:2009 - A quality management approach for managing the sustained success of an organization
- ISO 19011: Guidelines for quality and/or environmental management systems auditing

Even though the ISO 9000 family comprises of other standards, ISO 9001 is the only standard used for certification (Hoyle, 2009). Before the year 2000, ISO 9001, ISO 9002 and ISO 9003 assessment standards were being used for certification and hence the term "ISO 9000 certification" was applicable to any of the three standards' certification. However, after the declaration of ISO 9002 and ISO 9003 as obsolete in 2003, certification has been explicitly referenced as ISO 9001 certification. The revisions of ISO 9000 standards were carried so that resulting ISO 9001 standard would be compatible with other ISO standards specifically ISO 14001 environmental management system (Von Zharen, 2001).

Quality Management System. According to Hoyle (2009), "A quality management system is set of interacting processes designed to function together to fulfill quality objective (p.117)." ISO 9001 standard provides a set of standardized requirements required for establishing a quality management system in an organization irrespective to its size, nature, scope and deliverables. Organizations use ISO 9001 certification to enhance their confidence and capability in providing quality product and services, improving business performances and making supplier selection process easier (Cianfrani, Tsiakals, & West, 2009). According to Hoyle (2009), the ISO 9001:2008 model is a process-based quality management system with the influence of customer and supplier behavior on the organization's outputs.

Quality Management Principles. According to Hoyle (2006), the quality management system standard ISO 9001:2008, which is the succession of ISO 9001:2000 version, is based on eight quality management principles that assist senior management in guiding their management towards continual improvement and those principles are as follows:

1. Customer focus: Organization must put its effort in satisfying the customer needs and should organize work as a process that meets or exceeds customer expectation
2. Leadership: Leaders are the ones who are consistent with the organizational values and drive organization by uniting everybody within the organization towards achieving objectives
3. Involvement of people: People at every levels of an organization are equally important and their active participation as a work force is crucial for organizational benefits
4. Process approach: For achieving a desired result, the available resources and activities are required to be managed as a process
5. System approach to management: Organization should identify, understand and manage interrelated processes as a system so as to enhance its effectiveness and efficiency in achieving its objectives
6. Continual improvement: Organization should consider continual improvement of its overall performance as the most important objective
7. Factual approach to decision-making: The decisions based on the analysis of data and information are effective and assist in simplifying organizational procedure for decision making

8. Mutually beneficial supplier relationships: A mutually beneficial relationship between an organization and its suppliers enhances the capability of both to improve performance and create value

These eight principles are embedded within the clauses of ISO 9001 and together describe the quality management in an organization. The ISO 9001 standard does not necessarily demand for certification, however, an organization may seek certification from an independent quality system certification body after it has successfully implemented quality management system (Hoyle, 2009). ISO 9001 certification does not make any difference to the way the organization is managed, neither does it provide a guarantee of quality product or service, but it is likely to add significant value to the organization which helps in winning confidence of customers and suppliers (Hoyle, 2009). ISO 9001 certification is also used to gain market advantage and as a means of advertisements promoting the business (Cianfrani et al., 2009).

Benefits of ISO 9001. Establishing ISO 9001 quality management system helps an organization in following ways:

- Provides for work performance consistency
- Enables to discover causes of poor performances
- Helps in defining goals and objectives
- Stresses in process approach
- Provides benchmarks to measure improvements
- Helps to gain customer confidence
- Helps in maintaining clarity of responsibility and authority
- Helps in maintaining consistent quality

- Helps in international trade
- Helps in improving cycle time and efficiency

ISO 14000 Series

ISO 14000 is a series of international standards on environmental management that provides a framework for the development of an environmental management system and respective audit programme (Von Zharen, 2001). After the success of ISO 9000 standards and increase in awareness of the environmental protection, ISO formed the Strategic Advisory Group on the Environment (SAGE) in 1991 which carried out intensive conversations among 20 countries, 11 international organizations and more than 100 environmental experts to define the basic requirements of a new approach to environment related standards (Von Zharen, 2001). The development of ISO 14000 seem to have begun after ISO's commitment to support the sustainable development in United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro in 1992 (Von Zharen, 2001).

In 1993, after the recommendation of SAGE, ISO launched the new technical committee ISO/TC 207 for environmental management comprising representatives from industry, standardization organizations, governmental and environmental organizations from various countries of the world (Environment Protection Agency, 2010). ISO published ISO 14001 and ISO 14004 standards in 1996 for the first time (Von Zharen, 2001). Currently, ISO TC 207 comprises of delegations of business and government experts from 75 countries, observers from another 25 countries and 41 international or regional organizations including United Nations Conference on Trade and Development (UNCTAD), United Nations Environment Program (UNEP), World Health Organization (WHO) and World Trade Organization (WTO).

The ISO 14000 family consists of standards and guidelines relating to environmental management systems which essentially focus on what an organization does to minimize harmful effects on the environment caused by its activities and achieve continual improvement of its environmental performance (ISO, 2010). ISO 14001 is the only specification standard which provides the requirements of an environmental management system (EMS) whereas ISO 14004 provides the guidelines required for EMS (Von Zharen, 2001). The other standards in the family address specific environmental aspects including labeling, life cycle analysis, performance evaluation, communication and auditing.

Environmental Management System. An environment management system (EMS) based on the requirements of ISO 14001 is a management tool that enables an organization of any type or size in identifying and controlling the environmental impacts of its activities, continually improving its environmental performance implementing a systematic approach in setting environmental objectives and demonstrating that such objectives have been successfully achieved (ISO, 2010). ISO 14001 is applicable to all types and sizes of organizations including service and business sectors and is the only specific standard of ISO 14000 series against which an organization's EMS is evaluated and certified (Von Zharen, 2001). At present, ISO 14001:2004 version of the standard is being used for the certification purpose and the main intention of this standard is to provide a framework for a holistic and strategic approach to the organization's policy, plans and actions (ISO, 2010). ISO 14001 requires the commitment of management and employees for the protection of environment with clear assignment of accountability and responsibility (Voorhees, & Woellner, 1998).

ISO 14001 specifies EMS requirements that an organization should meet in order to get certified from a certification body (Whitelaw, 2004). According to EPA (2010), the essential requirements of an environment management system (EMS) under ISO 14001include:

- A policy statement that includes commitment to prevention of pollution, continual improvement of EMS and compliance with all applicable statutory and regulatory requirements
- Identification of all the aspects of an organization's activities, product and services that can have significant impact on the environment
- Setting environmental objectives and targets
- Implementing the EMS to meet the objectives
- Establishing an internal audit program
- Monitoring and measurement of the performance of the system and taking subsequent corrective and preventive action when the deviations occur in the system
- Periodic reviews of the EMS by top management to ensure its continual improvement

The key elements of ISO 14001 essential for implementing environmental management system are environmental policy, planning, implementation and operation, checking and corrective action and management review (Von Zharen, 2001). According to Whitelaw (2004), ISO 14001 standard is comprised of following clauses: General Requirements (clause 4.1), Environmental Policy (clause 4.2), Planning (clause 4.3), Implementation and operation (clause 4.4), Checking and corrective actions (clause 4.5), and Management review (clause 4.6). Planning further consists of environmental aspects, legal and other requirements, objectives, targets and programme(s); implementation and operation consists of resources, roles, responsibility and authority, competence, training and awareness, communication,

documentation, control of documents, emergency preparedness and response; checking consists of monitoring and measurement, evaluation of compliance, nonconformity, corrective action and preventive action, control of records, internal audit (Whitelaw, 2004).

Benefits of ISO 14001. ISO 14001 encourages top management to have a critical look at areas that are vulnerable to environmental impacts. According ISO (2010) some of the potential benefits of an EMS based on ISO 14001 are as follows:

- Framework for meeting EMS objectives and continual improvement of environmental performances
- Increased efficiency and potential cost savings
- Optimized used of environmental management resources
- Improved corporate image among customers, regulators, stakeholders and public
- Consistency in managing environmental obligations
- Lower distribution cost

Integrated Management System

The global competition has compelled organizations to invest their resources in enhancing their management efficiency and this has resulted in profound changes affecting every aspects of business including customer care, supplier management, strategy identification and implementation, process engineering and human resources (Renzi, & Cappelli, 2000). Organizations implement available methods and approaches as a means of improving their performance and business system. There are various practices, disciplines and processes within an organization each meant for a separate objective. Combining all those practices, principles and processes into one system so as to address a particular objective is known as their integration into a system (Hoyle, 2009). Integrated management system is an important tool for an

organization which helps in improving process, increasing competitiveness and strategy realization (Spilka, Kania, & Nowosielski, 2009). According to Hoyle (2009), the term "integration" itself is a vague topic and should explicitly refer about what is being integrated. For example, integration can be perceived as integrating documentation, integrating management, integrating standards, integrating functions or integrating systems.

Organizations adopt management systems according to their need and scope. ISO 9001 serves for the requirement of quality management, ISO 14001 for the environmental management system and OHSAS 18001 addresses occupational health and safety issues (McDonald, Mors, & Phillips, 2003). It is likely that organizations implementing ISO 14001 have an existing quality management system meeting the requirements of ISO 9001 in place. Management systems are sometimes obligations of customers to the suppliers which require suppliers to be registered to a quality standard such as ISO 9001 or QS-9000 in addition to ISO 14001(McDonald et al., 2003). According to Whitelaw (2004), the need for integrated management systems has long been felt and there have been attempts on the development of one definitive standard that could address all of an organization's activities and could be used as a model for the successful running of the business. The degree to which an organization integrates its management systems depends on its specific needs and the organization is required to evaluate the management systems and plan for their integration as per the business needs. The organizations that successfully integrated portions or all of their management systems have reported to have achieved significant returns on their investment due to reduced operating cost and increased overall performance (McDonald et al., 2003).

Integration of ISO 9001 and ISO 14001 Management Systems. The latest version of both standards, ISO 9001:2008 and ISO 14001:2004 have been developed with the specific intent to be compatible with each other (Cianfrani et al., 2008). The correspondence between the two standards can be seen in Appendix C and Appendix D. According to Cianfrani et al., (2008), the drafters of two families had worked together in developing ISO 9001:2000 and ISO 14001:2004 so that both the standards would be compatible and during the development of ISO 9001:2008, following considerations related to the compatibility of both the standards were emphasized (p. 9):

- ISO 9001:2008 is structured to enhance its usability with ISO 14001:2004.
- ISO 9001:2008 and ISO 14001:2004 can be used together without unnecessary duplication or conflicting requirements.
- Common requirements can form a basis for integrated management systems.
- Quality management system processes need not be established separately from an existing management system.

The degree of integration of quality and environmental management systems into a single system must be based on the specific needs and values of business and should be carried out as long as it is functional to the organization (Jackson, 2001; Renzi, & Cappelli, 2000). The fact that both the standards comply with the definition of "system" and share some common elements makes it possible for their integration (Renzi, & Cappelli, 2000). Renzi and Cappelli (2000) further pointed out that the maximum benefit could be achieved by better exploiting the common aspects and synergies in the two standards.

ISO 9000 and ISO 14000 series are based on a proactive standpoint emphasizing prevention rather than corrective action and both focus on general management issues with an

emphasis on systems (Von Zharen, 2001). ISO 9001 and ISO 14001 standards are based on plan-do-check-act (PDCA) model and focus on continual improvement (McDonald et al., 2003). The elements of ISO 14001 standard under the implementation and evaluation requirement are almost identical to those of ISO 9001 standard (Block, 2000). The need for documents, document control, training, control of non-conformances, corrective and preventive action, internal audits, management review and records have similar requirements and have similar title (Hartstern, 1997). Both of the standards have requirement of commitment from the top management of the organization in the form of a policy statement and establishment of objectives (Black, 2000; Jackson, 2001). In summary, there are sufficient requirements common to ISO 9001 and ISO 14001 standards that provide the basis for the integrated management system.

Possible Barriers of Integration. Even though ISO 9001 and ISO 14001 standards emphasize on process approach, some differences still exist between the standards. For example, ISO 9001 does not provide specific performance specifications whereas ISO 14001 strictly requires such specifications (Hoyle, 2009). Hartstern (1997) has pointed out identification of the distinct differences between the two standards and incorporation of all the requirements into a business strategy of an organization as the major challenge for integration process. ISO 9001 requires system documentation in the form of a manual, whereas ISO 14001 does not specify for the need of such manual even there is the requirement for system documentation (Block, 2000). Even though ISO 9001 and ISO 14001 require management to establish policy identifying objectives and implementation of the specific management system of the organization, only ISO 14001 requires such policy to be made available to public (Hartstern, 1997).

ISO 9001 has a specific requirement for a contract review procedure required to perform reviews prior to accepting any contract and to identify that the requirements for the contract are adequately defined and documented (Hartstern, 1997; Jackson, 2001). On the other hand ISO 14001 requires a procedure to identify legal and other requirements which are related to environmental aspects of an organization's activities, products or services (Hartstern, 1997). ISO 9001 has a specific requirement for design control which is applicable to the product design process and requires a design control procedure for the purpose (Hartstern, 1997). ISO 14001standard requires a procedure to identify the environmental aspects of an organization's activities, products and services and system to respond in case of an emergency (Hartstern, 1997; Jackson 2001). Quality management system focuses on customer satisfaction and quality of product or service whereas environmental management system emphasizes in satisfying requirements for stakeholders, regulatory bodies, local communities and minimizing environmental impacts (Hoyle, 2009; Von Zharen, 2001).

In summary, even some of the requirements of ISO 9001 and ISO 14001 standards are somewhat different and specific to each management standards; they are not mutually exclusive and can fit into the integrated management system to achieve both quality and environmental performance (Hartstern, 1997).

Benefits of Integrated Management System. Implementing separate ISO programs within an organization to meet the organizational needs is likely to result into massive document system, increased financial burdens and increased implementation time (Culley, 1996). Parallel management systems lead to separate and independent implementations of each system which suffer from several drawbacks like the duplication of management tasks, such as written procedures, checking, control forms and other documents as required by each system (Spilka et

al., 2009). With one system in place, it is likely to be more effective and efficient in making everyone in the organization responsible for product or service quality and environmental performance with continuous improvement in all operations (Hartstern 1997). According to McDonald et al. (2003) integrating management systems helps organization by simplifying systems, optimizing resources, providing common framework for continual improvement and improving overall organizational performances.

Summary

The comprehensive study of the literature provided the information related to the history ISO, ISO standards and their development processes, and benefits of standards to organization, public, individuals, countries and the world. The literature review of related articles and journals also provided information regarding the similarities and differences between the ISO 9001 and ISO 14001standards and highlighted on the possibility of integrating quality management system and environmental management system, its benefits and possible barriers for such approach.

Chapter III: Methodology

Implementing parallel management systems within an organization can be financially onerous and operationally challenging. In order to reduce the financial and operational burdens, the possibility of integration of the quality management system based on ISO 9001:2008 and environmental management system based on ISO 14001:2004 was studied by comparing the elements ISO 14001:2004 against the elements of ISO 9001:2008. The clauses of ISO 14001:2004 standard were compared with the corresponding clauses of ISO 9001:2008 according to the comparison table in Appendix C.

Corresponding Clauses

In this section, the clauses of ISO 14001 were analyzed and compared with the corresponding clauses of ISO 9001. The correspondence was as follows:

Introduction. This section of ISO 14001 is an introductory section of the standard and highlights on the introduction of the standard. The corresponding clauses in ISO 9001:2008 are as follows:

- General, clause 0.1: This clause does not form part of the requirements of ISO 9001:2008 but it exists to provide general introduction and understanding of the standard. This clause highlights the flexible and versatile property of ISO 9001:2008 standard.
- Process approach, clause 0.2: This clause highlights on justifications why an organization needs to base the quality management system on the process approach. It also gives brief guidance on the requirement of an organization to identify and manage quality management system processes and their interactions as required by clause 4.1.
- Relationship with ISO 9004, clause 0.3: This clause describes the relationship between ISO 9001:2008 requirements and ISO 9004. ISO 9004 provides guidelines for a quality

management system that focuses on performance improvement and broader application to long-term survival.

- Compatibility with other management system, clause 0.4: This clause highlights on the compatibility of ISO 9001:2008 with other management system standard, specifically ISO 14001:2004. This clause also focuses on the possibility of integration of the two standards and possible benefits of using together.

Scope. This is the first clause of ISO 14001 and it provides the foundation for the environmental management system. It assists an organization in defining its boundaries to include those areas where its activities take places, where it has direct control and under which it has environmental regulatory liability. The areas which are outside of organization's direct control but are under some sort of influence are also included in the scope. The scope simply provides a model for an organization to ensure that its environmental management system conforms to the environmental policy and demonstrates its conformity to the requirements of the standard. The corresponding clauses in ISO 9001:2008 are as follows:

- Scope, clause 1: The correspondence is limited to the title of scope only. The scope constitutes a normative part of the standard and does not constitute specific requirements for the quality management system.
- General, clause 1.1: This clause specifies requirements for a quality management system where an organization needs to demonstrate its capability of providing product that meets customer requirements, applicable statutory and regulatory requirements and aiming for enhancing customer satisfaction and continual improvement through the effective application of the quality management system.

- Application, clause 1.2: This clause states that the requirements of the standard are generic and are applicable to all organizations, regardless of type, product and size. The clause also allows a provision to exclude those requirements within clause 7 which are not required by the nature of the product or service or are not required in order to meet customer requirements.

Normative References. This section comes under clause 2 of ISO 14001 and does not include any reference. This clause is retained for the sake of numbering so that clause numbering of the standard is identical with the previous edition (ISO 14001:1996). The corresponding Normative references clause comes under clause 2 of ISO 9001:2008 standard and ISO 9000:2005 constitutes the only reference ISO 9001:2008. The fundamentals of ISO 9000:2005 clause 2 provide a framework of understanding that is useful for the implementation of ISO 9001:2008.

Terms and Definition. This section comes under the clause 3 of ISO 14001 and contains key words that define the scope of the standard and interpret specific requirements of the environmental management system. Corresponding clause to this clause in ISO 9001:2008 is Terms and definition, clause 3 and terms and definitions given in ISO 9000 apply to the purpose of this clause. It also states that the term "product" can be used as "service" throughout the standard.

Environmental Management System Requirements. This is the clause 4 of ISO 14001 and contains the requirements needed for a certifiable environmental management system based on ISO 14001 and is used in assessing the conformance of the system to the standard. This clause corresponds to the title of Quality management system, clause 4 of ISO 9001:2008 standard.

General Requirements. This is the clause 4.1 of ISO 14001 and is all about establishing, documenting, implementing and continually improving the environmental management system in an organization and showing the evidence that all the requirements of the standard are met. The corresponding clauses of ISO 9001:2008 are as follows:

- General requirements, clause 4.1: This is about establishing, documenting, implementing and continually improving the quality management system in an organization and showing the evidence that all the requirements of the standard are met.
- Responsibility, authority and communication, clause 5.5: The correspondence of this clause is limited to the title only.
- Responsibility and authority, clause 5.5.1: This clause requires the top management to ensure that responsibilities and authorities are defined and communicated within the organization. It requires that the clarity of roles and responsibilities are maintained at least among the key personnel involved in the quality management system.

Environmental Policy. This is the clause 4.2 of ISO 14001 and requires the top management of an organization to develop a policy relative to the scope of environmental management system and conforms to the standard. There are some specific things like compliance with legal and other requirements, prevention of pollution and continual improvement that must be incorporated in the policy. Additionally, the policy is required to be communicated to all employees and must be made available to public as well. It is also required that the policy be well documented, implemented and maintained. The corresponding clauses in ISO 9001:2008 are as follows:

- Management commitment, clause 5.1: This clause requires top management to provide its commitment to the development and implementation of quality management system and

continually improve its effectiveness by establishing quality policy and objectives, ensuring the availability of resources, conducting management reviews and communicating the importance of meeting customer and other requirements to the organization.

- Quality policy, clause 5.3: This clause requires the top management to establish a quality policy appropriate to the needs of the organization and its customers and commit to comply with requirements, continually improve the effectiveness of the quality management system and communicate the policy throughout the organization. The policy needs to provide a framework for establishing and reviewing quality objectives and is required to be reviewed periodically.
- Continual improvement, clause 8.5.1: This clause requires an organization to continually improve the effectiveness of its quality management system through the use of quality policy and objectives, audits, corrective and preventive actions and management review. This clause does not require specific documentation, however, the documentation required to comply other clauses has direct correlation with the effectiveness of this clause. Hence it is important to consider documenting quality policy, quality objectives, management review, corrective action and preventive action to drive the improvement process throughout the organization.

Planning. This element comes under the clause of 4.3 of ISO 14001 and corresponds to the title of clause 5.4 of ISO 9001:2008.

Environmental Aspects. This element comes under the clause 4.3.1 of ISO 14001 and requires identification of those activities, products or services of an organization that have an impact on the environment. It requires a procedure to be developed to identify such aspects and

related impacts that the organization can control and determine those which are significant to the organization. This element needs to be up to date so as to ensure that the management system is continually improving. Although this element does not have parallel element in the quality management system, a fair correspondence between following clauses of ISO 9001 can be traced out as follows:

- Customer focus, clause 5.2: This clause requires the top management to ensure that customer requirements are determined, understood and fulfilled. There must be processes to demonstrate that these requirements are met. This clause does not require any specific record, however it is required that the processes to communicate customer, regulatory and legal requirements are documented.
- Determination of requirements related to the product, clause 7.2.1: This clause requires an organization to determine the stated and implied requirements of the customer including requirements for delivery and post-delivery activities, statutory and regulatory requirements applicable to the product and any additional requirements considered by organization. This clause does not necessarily require specific records, but it requires having a documented procedure to determine all aspects of customer requirements.
- Review of requirements related to the product, clause 7.2.2: This clause requires the organization to review every requirement related to the product and ensure that product requirements are defined, outstanding or unsettled requirements are resolved and documents related to changed requirements are amended and communicated. This clause requires specific records to be maintained.

Legal and Other Requirements. This element comes under clause 4.3.2 of ISO 14001 and requires an organization to be aware of its entire legal and other obligation and develop a

procedure to identify the environmental, legal and other requirements that are relevant to its operations, activities and services. It is also necessary that such information is communicated to key functions within the organization. The corresponding clauses in ISO 9001:2008 are as follows:

- Customer focus, clause 5.2: Discussed previously as the corresponding clause to Environmental aspects, clause 4.3.1 of ISO 14001.
- Determination of requirements related to the product, clause 7.2.1: Discussed previously as the corresponding clause to Environmental aspects, clause 4.3.1 of ISO 14001.

Objectives, Targets and Programme(s). This comes under the clause 4.3.3 of ISO 14001 and requires an organization to ensure that the objectives and targets and are consistent with the policy which includes the commitments to compliance with legal and other requirements, continual improvement and prevention of pollution. It is also required that significant aspects, legal and other requirements, issues related to technological, financial and business be considered and documented. In addition to this it requires to include the outline of roles, responsibilities and authorities associated with specific objectives and targets and the process for approving objectives and targets. The corresponding clauses in ISO 9001:2008 are as follows:

- Quality objectives, clause 5.4.1: This clause requires top management to establish objectives that are quantifiable and consistent to the policy and continual improvement of the effectiveness of the quality management system. The processes important to meet the requirements must be thoroughly understood before setting the objectives and those which are set cross functionally should be mutually supportive.

- Quality management system planning, clause 5.4.2: This clause requires the top management to ensure that the planning of quality management system is carried out in order to meet the general requirements, quality policy and objectives. It also requires that the integrity of the quality management system is maintained when changes to the quality management system are made and such changes may result due to modifications to organizational structure, personnel turnover, technological changes or changes in the volume.
- Continual improvement, clause 8.5.1: Discussed previously as the corresponding clause to Environmental policy, clause 4.2 of ISO 14001.

Implementation and Operation. This element comes under the clause 4.4 of ISO 14001and provides requirements for developing capabilities and support mechanisms necessary to implement environmental policy and achieve objectives. The correspondence of this clause is limited to the title of Product realization, clause 7 of ISO 9001.

Resources, Roles, Responsibility and Authority. This element comes under the clause 4.4.1 of ISO 14001 and it requires that roles, responsibilities and authorities within the organization are identified, documented and communicated. It also requires top management to ensure that resources to implement environmental management system are available and appoint a management representative. The management representative can be anybody from within the organization's management team who, irrespective of other responsibilities, oversees the environmental management system and report its performance to the management. The corresponding clauses in ISO 9001:2008 are as follows:

- Management commitment, clause 5.1: Discussed previously as the corresponding clause to Environmental policy, clause 4.2 of ISO 14001.

- Responsibility and authority, clause 5.5.1: Discussed previously as the corresponding clause to General requirements, clause 4.1 of ISO 14001.
- Management representative, clause 5.5.2: This clause requires the top management to appoint a member of organization's management who irrespective of other responsibilities, ensures that the processes needed for quality management system are established, implemented, and maintained. The management representative is responsible for communicating the performance of the quality management system to the top management and quality requirements of customers throughout the organization. Additionally, the management representative is responsible of acting like a resource person for the outside parties in relation to the quality management system.
- Provision of resources, clause 6.1: This clause requires an organization to provide all the resources necessary to implement and maintain the quality management system. This includes personnel, equipments, supplies, utilities, software, buildings, vehicles and instruments.
- Infrastructure, clause 6.3: This clause requires an organization to determine and maintain the infrastructure which may include buildings, workspace, utilities, process equipments, transport vehicles or information system as applicable, needed to achieve conformity to product or service requirements.

Competence, Training and Awareness. This is the clause 4.4.2 of ISO 14001and requires an organization to ensure that its personnel are adequately trained, competent and aware of their roles and responsibilities within environment management system. The organization needs to develop a procedure in identifying training needs necessary to achieve environmental

objectives and provide competency training to those whose work may have significant impact on the environment. The corresponding clauses in ISO 9001:2008 are as follows:

- General (Human Resources), clause 6.2.1: This clause requires the personnel those can affect conformity to product requirements are competent on the basis of appropriate education, training, skills and experience.
- Competence, training and awareness, clause 6.2.2: This clause requires an organization to determine necessary competence and training needs for those personnel whose work may affect the conformity to product requirements and provide necessary trainings to them. Additionally, it also requires evaluating the effectiveness of the actions taken and making all the personnel aware of their importance in achieving quality objectives and implementing quality management system. It requires documenting the training plan to address the training needs of personnel and maintain records related to personnel education, experience, training and qualifications.

Communication. This is the clause 4.4.3 of ISO 14001. It requires an organization to develop a procedure ensuring that the communications related to the environment management system are communicated to all employees as an internal communication. It also requires developing another procedure for receiving, documenting and responding to the external interested parties as an external communication. The records of both internal and external communication need to be maintained. The corresponding clauses in ISO 9001:2008 are as follows:

- Internal communication, clause 5.5.3: This clause requires the top management to establish proper communication processes within the organization so as to assure the effectiveness of the quality management system.

- Customer communication, clause 7.2.3: This clause requires an organization to establish proper communication arrangements with customer regarding the product information, orders or contract inquiries and customer feedback and complaints.

Documentation. This is the clause 4.4.4 of ISO 14001and it requires an organization to document all the elements of environmental management system and their interrelationship in either electronic or paper form so as to ensure that the requirements of ISO 14001 are met. The documents need to be updated periodically. The corresponding clauses in ISO 9001:2008 are:

- General (Documentation requirements), clause 4.2.1: This clause requires the statements of quality policy, quality objectives, procedures required by the standard are documented and a quality manual is developed. It also requires the system's processes and their interactions are documented.
- Quality manual, clause 4.2.2: This clause requires an organization to establish and maintain a quality manual that includes the scope of quality management system, details and justifications for any exclusion, documented procedures necessary for the system and the description of interaction between the processes and quality management system.

Control of Documents. Control of documents comes under clause 4.4.5 of ISO 14001 and under clause 4.4.3 of ISO 9001. This clause in both the standards requires an organization to have procedures for controlling all the necessary documents, distributing current versions and removing obsolete ones. It requires developing procedures that ensure the document are created, approved prior to use, reviewed and updated as necessary, accessible to appropriate personnel, maintained in an orderly manner, retained for specified period of time and obsolete documents are properly marked and stored. It also requires that the documents remain legible and readily identifiable.

Operational Control. Operational control is the clause 4.4.6 of ISO 14001 and it requires an organization to identify and mange each operation and activity that has significant impact on the environment. There should be procedures ensuring that the organization conforms to the policy, objectives and targets, legal and other requirements and addresses any impacts from significant aspects. There are following clauses in ISO 9001:2008 which correspond to this clause:

- Planning of product realization, clause 7.1: This clause requires an organization to plan and develop the processes needed for product realization. Planning is required to be consistent with the requirements of the other processes of the quality management system should ensure that quality objectives and requirements for the product are addressed along with the need to establish appropriate processes and documentation. Such planning should also be able to address the need of providing product specific resources, verification, validation, monitoring, measurement, inspection, test activities and criteria for acceptability of the product.
- Customer related processes, clause 7.2: The correspondence of this clause is limited to the tile.
- Determination of requirements related to the product, clause 7.2.1: Discussed previously as the corresponding clause to Environmental aspects, clause 4.3.1 of ISO 14001.
- Review of requirements related to the product, clause 7.2.2: Discussed previously as the corresponding clause to Environmental aspects, clause 4.3.1 of ISO 14001.
- Design and development planning, clause 7.3.1: This clause requires an organization to make sure that design and development of a product are planned and controlled so as to meet the defined requirements. During such planning, stages of projects, responsibilities

and authorities for design and development are required to be determined along with the review, verification and validation that are appropriate to each design and development stages.

- Design and development inputs, clause 7.3.2: This clause requires that every inputs which include functional and performance requirements, statutory and applicable requirements, design and development requirements and previous information related to the design are determined and records are maintained.
- Design and development outputs, clause 7.3.3: This clause requires that the design and development outputs are provided such a way that can be used for subsequent verification against the design and development inputs and should be approved before release. Such outputs should also provide appropriate information for production, purchasing and service provision and specify the characteristics of the product that are essential for its safe and proper use.
- Design and development review, clause 7.3.4: This clause requires that systematic reviews of design and development are performed to ensure that the requirements of the product are met and any problems associated are identified. It also addresses the issues related to the manufacturability, deliverability, testability, reliability, and ability of the new product.
- Design and development verification, clause 7.3.5: This clause requires that verification is carried out at planned intervals to ensure that design and development outputs have met the design and development input requirements. Verification can be done by data analysis and review, alternative calculations, additional testing and any other suitable

means. The process of performing the verification is to be documented and records of the result of verification are required to be maintained.

- Design and development validation, clause 7.3.6: This clause requires that after the successful verification of design and development, validation is carried out at planned intervals to ensure that the resulting product is capable of meeting the specified or intended requirements. The process for performing design and development validation requires to be documented and the records of the results of the validation are required to be maintained.
- Control of design and development changes, clause 7.3.7: This clause requires that the changes made to the design and developments are identified and the records are maintained. It also requires that the changes are reviewed, verified, validated and approved before implementation. The effect of the changes is required to be evaluated and followed-up as necessary.
- Purchasing process, clause 7.4.1: This clause requires an organization to ensure that the purchased material conforms to the purchase requirements and appropriate control is applied to the supplier and the purchased material depending upon the effects on the product realization process and the resulting product. It also requires that procedures for supplier evaluation and supplier selection are developed and the records of the results of evaluation are maintained.
- Purchasing information, clause 7.4.2: This clause requires developing a documented procedure to ensure that information about the product to be purchased is described along with the requirements for approval of product, procedures, processes, equipments,

personnel qualification and quality management system requirements. It requires maintaining records of purchased material documents and their reviews.

- Verification of purchased product, clause 7.4.3: This clause requires an organization to establish the procedures to ensure that purchased product conforms to the requirements. Additionally, it also requires developing a documented procedure for verification and product release if such verification activities are performed on the premises of the supplier.
- Production and service provision, clause 7.5: The correspondence of this clause is limited to the title only.
- Control of production and service provision, clause 7.5.1: This clause requires an organization to establish documented procedures necessary to produce and deliver products and services under controlled conditions which include the availability of information describing the characteristics of product, availability of work instruction, availability of suitable equipments, availability of monitoring and measuring equipments, implementation of monitoring and measurement and implementation of product release, delivery and post delivery activities.
- Validation of processes for production and service provision, clause 7.5.2: This clause requires an organization to validate all those processes for production and service provision where the outputs cannot be verified by subsequent monitoring and measurement so as to demonstrate the ability of the processes to achieve planned results. It requires defining the conditions and criteria for review, revalidation and approval of the processes and equipments, qualification of personnel and use of specific procedures. It

requires maintaining the records of process validation, equipment and personnel qualifications.

- Preservation of product, clause 7.5.5: This clause requires an organization to apply applicable measures of handling, packaging, storage, identification and protection of the product during phase of internal processing and delivery to the intended destination so as to ensure that it conforms to the requirements.

Emergency Preparedness and Response. This is the clause 4.4.7 of ISO 14001 and it requires an organization to establish procedures for identifying potential emergencies and plans to mitigate such emergencies. Additionally, it also requires the organization to test the plans where practicable, review and modify if necessary. The potential emergencies may include fires, chemical and oil spillage, flood, earthquake and other natural calamities. The emergency response procedures should include following:

- Identification and assessment of potential hazards
- Organizational structure with roles and responsibilities for emergency response
- Communication plan based on the type of emergency and hierarchical notification with contact information
- Availability and location of manuals, protective gears, equipments and other necessary materials
- Evacuation plans and evacuation site
- Shut-down procedures
- Trainings
- Tests and evaluation

The corresponding clause of emergency preparedness and response in ISO 9001 is

Control of nonconforming product, clause 8.3. This clause requires an organization to establish documented procedures to ensure that the product not conforming to the requirements are identified and controlled in order to prevent their unintended use or delivery. The documents should include the procedures for addressing the disposition of nonconforming product and measures to be taken when such products have reached to the customer. In case of rectification of the nonconformities, it is required to recertify and verify that such products conform to the requirements.

Checking. This is the clause 4.4.7 of ISO 14001. The title of this clause corresponds to the title of Monitoring, analysis and improvement, clause 8 of ISO 9001:2008.

Monitoring and Measurement. This is the clause 4.5.1 of ISO 14001 and it requires an organization to establish documented procedures for monitoring and measuring key parameters of those operations and activities which have significant impact on the environment. The organization is also required to develop procedures for tracking environmental objectives and targets and assessing regulatory compliance periodically. The organization is required to develop procedures to ensure that the calibration of measuring and monitoring equipment is done and appropriate records are maintained. The procedures for calibration should address the roles and responsibilities of personnel, equipment, frequency of calibration and methodology. The corresponding clauses of ISO 9001:2008 to the monitoring and measurement clause of ISO 14001 are as follows:

- Control of monitoring and measuring equipment, clause 7.6: This clause requires an organization to establish procedures to ensure that the monitoring and measuring equipments are controlled, verified against measurement standards traceable to national or international measurement standards, adjusted as necessary, protected from damage

and given identification to determine their calibration status. The validity of previous measuring results is required to be assessed and recorded when the equipment is not found conforming to the requirements. The records of calibration results and verification are required to be maintained.

- General (Measurement, analysis and improvement), clause 8.1: This clause requires an organization to develop procedures to achieve product realization and ensure that necessary monitoring, measurement and analysis, and improvement activities are implemented. This clause resembles with clause 7.1 (Planning of product realization) and clause 4.1 (General requirements) of ISO 9001 in terms of common requirements of planning, developing and deploying process model to be used for product realization, continual improvement and customer satisfaction.
- Monitoring and measurement of processes, clause 8.2.3: This clause requires an organization to apply suitable measures for monitoring and measuring all the relevant processes of quality management system to ensure that the processes are able to achieve the planned results. It also requires that corrective actions are taken when the planned results are not achieved.
- Monitoring and measurement of product, clause 8.2.4: This clause requires an organization to monitor and measure the characteristics of product at appropriated stages of product realization process in accordance with planned arrangements so as to verify that product requirements have been met. The records showing the conformity of the product to the requirements are required to be maintained. It is also required to establish the procedures for release of product and service to the customers.

- Analysis of data, clause 8.4: This requires an organization to determine, collect and analyze appropriate data to demonstrate the effectiveness and suitability of quality management system and to identify opportunities for continual improvement. The analysis of data should provide information related to customer satisfaction, conformity to product requirements, suppliers, trends and characteristics of processes and products and opportunities of preventive action.

Evaluation of Compliance. This is the clause 4.5.2 of ISO 14001 and it requires an organization to develop procedures to periodically evaluate its compliance with applicable legal and other requirements. It requires an organization to verify that applicable legislation has been identified, introduced to the organization and the requirements to the legislation have been made. The corresponding clauses of ISO 9001:2008 to evaluation of compliance are as follows:

- Monitoring and measurement of processes, clause 8.2.3: Discussed previously as the corresponding clause to Monitoring and measurement, clause 4.5.1 of ISO 14001.
- Monitoring and measurement of product, clause 8.2.4: Discussed previously as the corresponding clause to Monitoring and measurement, clause 4.5.1 of ISO 14001.

Nonconformity, Corrective Action and Preventive Action. This is the clause 4.5.3 of ISO 14001and requires an organization to establish procedures for investigating and resolving nonconformities in the environment management system along with subsequent corrective actions and preventive actions. This clause also requires that roles and responsibilities are defined for investigating nonconformities. The nonconformities can be identified thorough audits, monitoring and measurement, periodic inspection and communications. The intent of the clause is to find out the root causes of such nonconformities and take subsequent corrective action in order to mitigate the environmental impact and implement preventive actions to prevent

the recurrence in future. The results of corrective actions taken are required to be maintained and the effectiveness of such actions is required to be reviewed. The corresponding clauses in ISO 9001:2008 are as follows:

- Control of nonconforming product, clause 8.3: Discussed previously as the corresponding clause to Emergency preparedness and control, clause 4.4.7 of ISO 14001.
- Analysis of data, clause 8.4: Discussed previously as the corresponding clause to Monitoring and measurement, clause 4.5.1 of ISO 14001.
- Corrective action, clause 8.5.2: This clause requires an organization to establish procedures for reviewing the nonconformities, determining their causes, implementing corrective action needed and reviewing the effectiveness of the action taken. The nonconformities may be anything between major and minor and it is required to evaluate the need for actions to ensure that any of the nonconformities do not recur. This clause specifically requires an organization to maintain the records of corrective action required, root causes identified, actions taken, results of actions and review of the results.
- Preventive action, clause 8.5.3: This clause requires an organization to establish documented procedures for determining potential nonconformities and their causes, implementing appropriate preventive action and reviewing the effectiveness of the action. It is also required that the records of the potential root causes found, actions taken and results of such actions are maintained.

Control of Records. This is the clause 4.5.4 of ISO 14001 and it requires all records related to environmental training activities, monitoring and measurement, regulatory requirements, environmental audits, assessments, and other elements of environmental management system are maintained as an evidence of the system operating and organization's

conformance to the requirements of the environmental management system. It is required that the records are identifiable, legible, traceable, retrievable, protected against damage or loss and retained according to established documented procedures. It is required to establish procedures for maintaining records which should include information about the personnel responsible for managing records, types of records to be maintained, location where the records are to be kept, process of maintaining and retrieving of records, retention time and final disposition.

The corresponding clause for control of records in ISO 9001 is clause 4.2.4, Control of records and has similar requirements as of control of records of ISO 14001 standard. It requires an organization to establish a documented procedure to define the controls necessary for the identification, storage, retrieval, protection, retention and disposition of records of that provide the evidence of conformity to the requirements and the effective operation of quality management system.

Internal Audit. This is the clause 4.5.5 of ISO 14001 and requires an organization to establish and maintain a program and procedures for conducting periodic environmental management system audits to determine whether the system conforms to the requirement of ISO 14001 standards. The intent of this clause is to determine the functionality of all procedures, plans, and programs including monitoring and measurement for identification and compliance with regulations. This clause requires an organization to define environmental management system audit scope, develop audit procedures, determine audit frequency, select and provide trainings for internal auditors, perform audits as per the set frequency, maintain audit records and communicate the results to the management.

The corresponding clause of ISO 9001, clause 8.2.2, has similar requirements as internal audit of ISO 14001. It requires an organization to conduct internal audits at planned intervals to

determine whether the quality management system meets the requirements of ISO 9001and is effectively implemented and maintained. It requires establishing documented procedures defining scope of quality management system, describing responsibilities, developing audit plans and procedures, determining audit frequency, selecting internal auditors and providing them training, performing audits, reporting audit results and maintaining records.

Management Review. This is the clause 4.6 of ISO 14001 and it requires top management to periodically review the environmental management system to ensure that it is operating as planned, and is suitable, adequate and effective. The top management is required to develop the management review process, generate the schedule for the meetings, develop standard format for agenda discussion, conduct the meetings, keep minutes, list attendees at the meeting, ensure that action items are assigned and followed up on and periodically review the management procedures to ensure it is up-to-date and effective. The agenda for the meetings include review for the environmental management system performance, review of environmental policy and objectives, review on nonconformities, review on audit results, review on previous audits and actions, review of new inputs and changes to procedure, recommendations for improvements of environmental management system and selection of improvement actions to implement. The following clauses of ISO 9001:2008 correspond to the management review:

- Management commitment, clause 5.1: Discussed as the corresponding clause to Resources, roles, responsibility and authority, clause 4.4.1 of ISO 14001.
- Management review, clause 5.6: The correspondence with this clause is limited to the title only.
- General (Management review), clause 5.6.1: This clause requires the top management of the organization to review the quality management system at planned intervals so as to

ensure its suitability, adequacy and effectiveness. The review should address the need for changes to quality management system, quality policy, quality objective and opportunities for improvement. The records of management reviews are required to be maintained.

- Review input, clause 5.6.2: This clause requires that input for a management review should include results of audits, customer feedback, process performance and product conformity, status of preventive and corrective actions, follow-ups on previous management reviews, changes affecting the quality management system and recommendations for improvement. The review inputs are required to be presented as the agenda for discussion which help top management to assess the effectiveness of quality management system and take necessary actions in case the system does not conform to the requirements.
- Review output, clause 5.6.3: This clause requires the management of an organization to include any decisions and actions related to the improvement of effectiveness of the quality management system and its processes, improvement of the product related to the customer requirements and resources needed after reviewing the inputs.
- Continual improvement, clause 8.5.1: Discussed as the corresponding clause to environmental policy, clause 4.2 of ISO 14001.

Non-corresponding Clauses of ISO 9001

This section consists of those clauses of ISO 9001:2008 standards which do not have direct correspondence with any clauses of ISO 14001:2004 standard.

Work Environment. Work environment is the clause 6.4 and is related to the condition of work including physical, environmental and ergonomic factors under which work is

performed. This clause requires an organization to determine and manage environment that is essential for achieving product conformity.

Identification and Traceability. This is the clause 7.5.3 of ISO 9001 and it requires an organization to identify the status of product with respect to monitoring and measurement throughout product realization process. It also requires controlling such identification and maintaining the records so as to facilitate in the traceability of the product when required.

Customer Property. This is the clause 7.5.4 of ISO 9001 and requires an organization to identify, verify and protect the customer owned item or property while it is under the organization's control. Such property included tools, information, test software and shipping container.

Customer Satisfaction. This is the clause 8.2.1 of ISO 9001 and is one of the measures of assessing the performance of quality management system. It requires an organization to develop methods of obtaining information regarding customer satisfaction and customer perception about the performance of the organization. Examples of some of the sources for assessing customer satisfaction may include customer satisfaction survey, warranty claims, user opinion survey, compliments, customer complaints, direct communication with customer, trade association information, benchmarking data, and industry group information.

Chapter IV: Results

The purpose of the study was to analyze the elements of ISO 9001 and ISO 14001 standards and propose a methodology of integrating quality management system and environmental management system into a single management system. The study was conducted by comparing the corresponding clauses of ISO 14001:2004 and ISO 9001:2008 standards. As a result of the study, the elements of both the standards were categorized under four following headings depending to their correspondence and differences:

- Essentially same elements: Elements under this heading share similar titles and have similar requirements
- Similar elements: Elements under this heading share similar requirements but differ in the scope and field of application
- Elements unique to ISO 14001: Elements under this headings are very unique to the requirements of ISO 14001 and have no or a fair correspondence with those of ISO 9001
- Elements unique to ISO 9001: Elements under this headings are very unique to the requirements of ISO 9001 and have no correspondence with those of ISO 14001

Essentially Same Elements

This section consists of those elements of ISO 9001:2008 and ISO 14001:2004 that have essentially the same titles and requirements. Essentially same elements are as follows:

- Training, Awareness and Competence: This is a common element in both the standards which comes under the clause 6.2.2 for ISO 9001 and 4.4.2 for ISO 14001. Both the standards require to identify training needs and to develop procedures for providing training. This element helps in assessing training needs, provides procedures for training and focuses on competency of people. ISO 14001 has some specific requirements under

this element which includes basic environmental awareness training for the employees. A comprehensive training plan based on training need and competence assessment can serve the requirement of both the standards.

- Document Control: Control of document is essential for both ISO 9001 and ISO 14001standards. Clause 4.2.3 of ISO 9001 and clause 4.4.5 of ISO 14001 address the element Document control which is about controlling and managing documents required by the management systems. A common document control system can be developed to meet the requirements of both standards.
- Nonconformity, Corrective and Preventive Action: Both the standards require procedures to address nonconformities, carry out root cause analysis for such nonconformities and initiate corrective and preventive action in order to prevent their recurrence in future. Clause 4.5.3 of ISO 14001 addresses Nonconformity, corrective action and preventive action. The corresponding clauses to this element in ISO 9001 are Control of nonconforming product (clause 8.3), Analysis of data (clause 8.4), Corrective action (clause 8.5.2), and Preventive action (clause 8.5.3). Even though the types of nonconformities and their subsequent corrective and preventive actions might be different for both the standards, a common procedure fulfilling the requirements of both the standards can be developed.
- Control of Records: Records are essential to both standards as they provide evidence that the organizational system is operating and is in conformance with the requirements set forth by the standards. Clause 4.2.4 of ISO 9001 and clause 4.5.4 of ISO 14001 address Control of records. Both the standards require an organization to establish a documented procedure to define the controls necessary for the identification, storage, retrieval,

protection, retention and disposition of records of that provide the evidence of conformity to the requirements and the effective operation of the management systems. A single system of control of records can serve the requirements of the both the standards.

- Internal Audits: An internal audit is very important element of both the standards which helps in determining whether all plans, programs, procedures within system conform to the requirements or not. Clause 8.2.2 of ISO 9001 and clause 4.5.5 of ISO 14001 address the requirement of internal audit. Both the standards require an organization to conduct internal audits at planned intervals to determine whether the management system meets the requirements of the standards and to establish and maintain documented procedures for conducting periodic internal audits. A single auditing schedule, common set of procedures and personnel can serve the need of internal audit for both the standards. Besides this, additional guidance and training needed for auditors for each system can be developed without affecting the integrity of the standard.

Similar Elements

This section covers those elements in ISO 9001:2008 and ISO 14001:2004 standards which are similar but have some basic differences. Similar elements are as follows:

- Policy: This element comes under clause 4.2 of ISO 14001:2004 and clause 5.3 of 9001:2008. Both standards require top management to develop policy and assert commitment for continual improvement, and communicate the policy as appropriate. ISO 14001 requires some specific commitments for prevention of pollution, compliance with environmental and other legislation to be included in the policy and is made available to public. The policy of ISO 9001 does not have any specific requirements besides Management commitment (clause 5.1) and Continual improvement (clause

8.5.1), but requires the policy to provide framework for establishing and reviewing quality objectives and to be reviewed to ensure its continuing suitability. Despite some basic requirements in the policy of both the standards, it is possible to develop a comprehensive policy that can address the requirements of both the standards.

- Structure and Responsibility: Both standards require that roles, responsibilities and authority within the organization are defined, documented and communicated. This is a common element that comes under Resources, roles, responsibility and authority (clause 4.4.1) of ISO 14001 and Responsibility and authority (clause 5.5.1) of ISO 9001. In addition to this, Management commitment (clause 5.1), Management representative (clause 5.5.2), Provision of resources (clause 6.1) and Infrastructure (clause 6.3) of ISO 9001 have direct parallel to Resources, roles, responsibilities and authority, clause 4.4.1 of ISO 14001. A single set of job descriptions covering quality and environmental responsibilities including a common organizational structure can be developed to address the requirements of both the standards. Moreover, one management representative can be appointed to oversee the requirements of both the standards.
- Documentation: Documentation is a common requirement of ISO 9001 and ISO 14001 and it requires an organization to document all the elements and their interrelationships within the system in either electronic or paper form. ISO 14001 addresses documentation under the clause 4.4.4, while ISO 9001 addresses documentation requirements under General (clause 4.2.1) and Quality manual (clause 4.2.2). ISO 14001 does not specifically require a manual for the documentation, whereas ISO 9001 strictly considers manual as a requirement. Procedures, work instruction, forms and record formats required by the standards can be arranged under a single documentation program.

- Operational control: This element comes under clause 4.4.6 of ISO 14001 and is concerned with the control of operations and processes that are associated with significant environmental impact. Planning of product realization (clause, 7.1), Customer related processes (clause 7.2), Determination of requirements related to the product (clause 7.2.1), Review of requirement related to the product (clause 7.2.2), Design and development planning (clause 7.3.1), Design and development inputs (clause 7.3.2), Design and development outputs (clause 7.3.3), Design and development review (clause 7.3.4), Design and development verification (clause 7.3.5), Design and development validation (clause 7.3.6), Control of design and development (clause 7.3.7), Purchasing process (clause 7.4.1), Purchasing information (clause 7.4.2), Verification of purchased product (clause 7.4.3), Production and service provision (clause 7.5), Control of production and service provision (clause 7.5.1), Validation of processes for production and service provision (clause 7.5.2), and Preservation of product (7.5.5) have similar requirements as operational control. Even the specific activities and purposes of control addressed by some of the above mentioned clauses of ISO 9001 are different than that controls of ISO 14001, the means for control are similar and hence the integration of the above elements of both standards into a single head is possible.
- Monitoring and measurement: Monitoring and measurement is a common requirement of both the standards and it requires an organization to establish procedures for monitoring key parameters of the system. Monitoring and measurement is the clause 4.5.1 of ISO 14001 and has Control of monitoring and measuring equipment (clause 7.6), General (Measurement, analysis and improvement, clause 8.1), Monitoring and measurement (clause 8.2.3), Monitoring and measurement of product (clause 8.2.4), and Analysis of

data (clause 8.4) as corresponding clauses in ISO 9001. Even the matters being monitored are different and are specific to the each standards, common procedures and programs for monitoring and measurement can be established as an integration effort.

- Evaluation of compliance: It is an essential element of ISO 14001 which comes under the clause 4.5.2 and requires procedures for evaluating organization's compliance with applicable and other requirements. Monitoring and measurement of processes (clause 8.2.3) and Monitoring and measurement of product (clause 8.2.4) of ISO 9001 have similar requirements as of evaluation of compliance of ISO 14001.
- Management review: Management review is another common element between ISO 9001 and ISO 14001 which requires the top management of an organization to periodically review the performance of the management systems. Management review comes under the clause 4.6 of ISO 14001 while ISO 9001 has following corresponding clauses that jointly address the essence of management review: Management commitment (clause 5.1), Management review (General, clause 5.6.1), Review input (clause 5.6.2), Review output (clause 5.6.3), Continual improvement (clause 8.5.1). The agenda of discussion and area of interests in the management review required by ISO 9001 are different than those of ISO 14001. ISO 14001 includes a wide spectrum of requirements including environmental policy and objectives whereas ISO 9001 requirements focus on customer satisfaction and product and service conformity, quality policy and objectives. Despite the basic differences in the agenda and matter of discussion in the management review of ISO 9001 and ISO 14001, there is similarity in the intent of such reviews which is continual improvement. Hence there is a possibility of integration of management reviews required by both the standards and the development of common procedures.

Elements Unique to ISO 14001

This section consists of those elements which are specific to the requirements of ISO 14001. There are not direct parallels of these element with those of ISO 9001, however, these have a fair correspondence with the clauses of ISO 9001 and provide some room for integration in one way or the other. Elements that are unique to ISO 14001 are as follows:

- Environmental aspects: This element comes under the clause 4.3.1 of ISO 14001 and requires procedures to identify and assess the significance of environmental aspects and their subsequent impacts. Customer focus (clause 5.2), Determination of requirements related to the product (clause 7.2.1), and Review of requirements related to the product (clause 7.2.2) of ISO 9001 can be considered to have a fair correspondence with the environmental impacts where customer and product are considered important aspects of quality management system.
- Legal and other requirements: This element comes under the clause 4.3.2 of ISO 14001 and requires procedures to comprehensively identify and have access to information about an organization's regulatory and other requirements. This element can be considered parallel to Customer focus (clause 5.2) and Determination of requirements related to the product (clause 7.2.1) of ISO 9001.
- Objectives and targets: Even targets and objectives look as common requirements of ISO 9001 and ISO 14001, there are fundamental differences in their practical application. Clause 4.3.3 of ISO 14001 addresses Objectives, targets and programme(s) and the requirements of this clause are more detailed as separate environmental objectives at all relevant levels in the organization are required to be established. The standard also requires a comprehensive programme for setting and achieving the environmental

objectives and targets. On the other hand, ISO 9001 requires quality objectives, which comes under the clause 5.4.1, to be quantifiable and consistent with the quality policy. Quality management system planning (clause 5.4.2) and Continual improvement (clause 8.5.1) of ISO 9001 can be considered parallel to the comprehensive programme of ISO 14001 as these clauses emphasize on planning of management system in order to meet the general requirements, quality policy, quality objectives and continual improvement.

- Communication: Communication is essential requirement of ISO 9001 and ISO 14001 and organization is required to develop procedures for communication. ISO 14001 recognizes a wide range of interested parties for the environmental management system and categorizes those parties as internal and external. Communication (clause 4.4.3 of ISO 14001) emphasizes on the internal and external types of communication and requires separate procedures for each. Internal communication is between the employees within the organization whereas external communication is between organization and external parties including vendors, stakeholders, contractors, and public. ISO 9001 has provision of Internal communication (clause 5.5.3), the communication between employees within the organization; and Customer communication (clause 7.2.3), the communication between organization and customer including contract reviews, product information and contract inquiries. Although the scope of communication between ISO 9001 and ISO 14001 is different, a common communication procedure addressing the requirements of both the standard can be developed.
- Emergency preparedness and response: This is the specific requirement if ISO 14001which comes under the clause 4.4.7 and requires procedures identifying potential emergencies and plans mitigating such emergencies. There is no direct parallel of this

clause in ISO 9001; however, a fair correspondence can be drawn with the Control of nonconforming product (clause 8.3 of ISO 9001) which has similar approaches while dealing with nonconforming product.

Elements Unique to ISO 9001

This section consists of those elements which are specific to the requirements of ISO 9001. Elements that are unique to ISO 9001 are as follows:

- Work environment: This is the clause 6.4 of ISO 9001 which is related to the condition of work including physical, environmental and ergonomic factors under which work is performed. This clause requires an organization to determine and manage environment that is needed to achieve product conformity. There is no any correspondence of this element with those of ISO 14001.
- Identification and traceability: This is the clause 7.5.3 of ISO 9001 and requires an organization to identify the status of product with respect to monitoring and measurement throughout product realization process, control such identification and maintain the records so as to enhance in the traceability of the product when required.
- Customer Property: This is the clause 7.5.4 of ISO 9001 and requires an organization to identify, verify and protect the customer owned item or property while it is under the organization's control. Such property included tools, information, test software and shipping container.
- Customer Satisfaction: This is the clause 8.2.1 of ISO 9001 and is one of the measurements of the performance of quality management system. It requires an organization to develop methods of obtaining information regarding customer satisfaction and customer perception about the performance of the organization. Examples of some

of the sources for assessing customer satisfaction may include customer satisfaction survey, warranty claims, user opinion survey, compliments, customer complaints, direct communication with customer, trade association information, benchmarking data, and industry group information.

Integration Methodology

There is no formal international standard facilitating in the integration of management systems based on ISO 9001 and ISO 14001 standards, however, organizations use different methodologies to integrate such systems depending upon their need, existing workable system and scope of business. An integration of quality and environmental management systems can be carried out in following three ways:

- Establish quality and environmental management systems as separate entity and integrate them into a single management system later: This is a simple method of implementing both types of management systems as separate unit and later integrating both into a single system. This method is quite uneconomical as it requires additional resources and there is likely of duplicated works, procedures, and documents. Moreover, the integration process is more likely to be challenging and complicated as everything that is already built has to be modified and changed so as to facilitate integration.
- Establish one system first and then gradually integrate the other system: This is the most common type of integration and it usually follows by establishing quality management system first and then gradually incorporating the environmental management system. The quality management system provides the basic foundation for the implementing environmental management system and is rather easier than developing both the systems from scratch. As long as the systems are to be integrated, the elements of the

management system already developed have to be modified accordingly. This incurs repeated work, additional use of resources and time.

- Establish integrated management system from the base: This method is the most logical way of developing integrated management system as this will result in less repeated work including documentation and trainings, optimized resource utilization, synergy in the implementation process and flexibility in potential future modifications. However, this method is likely to be a difficult process to start with and will result in increased workloads. This method requires trained personnel, adequate resources and cooperation from every employee.

As a result of the research, a methodology to integrate quality and environmental management system was developed. The methodology is rather generic and is assumed to be equally applicable to those organizations with or without any existing management system in place. Figure 1 represents a flow chart of integrating quality management system and environmental management system within an organization.

Figure 1. Flow Chart of Integrated Management System Implementation

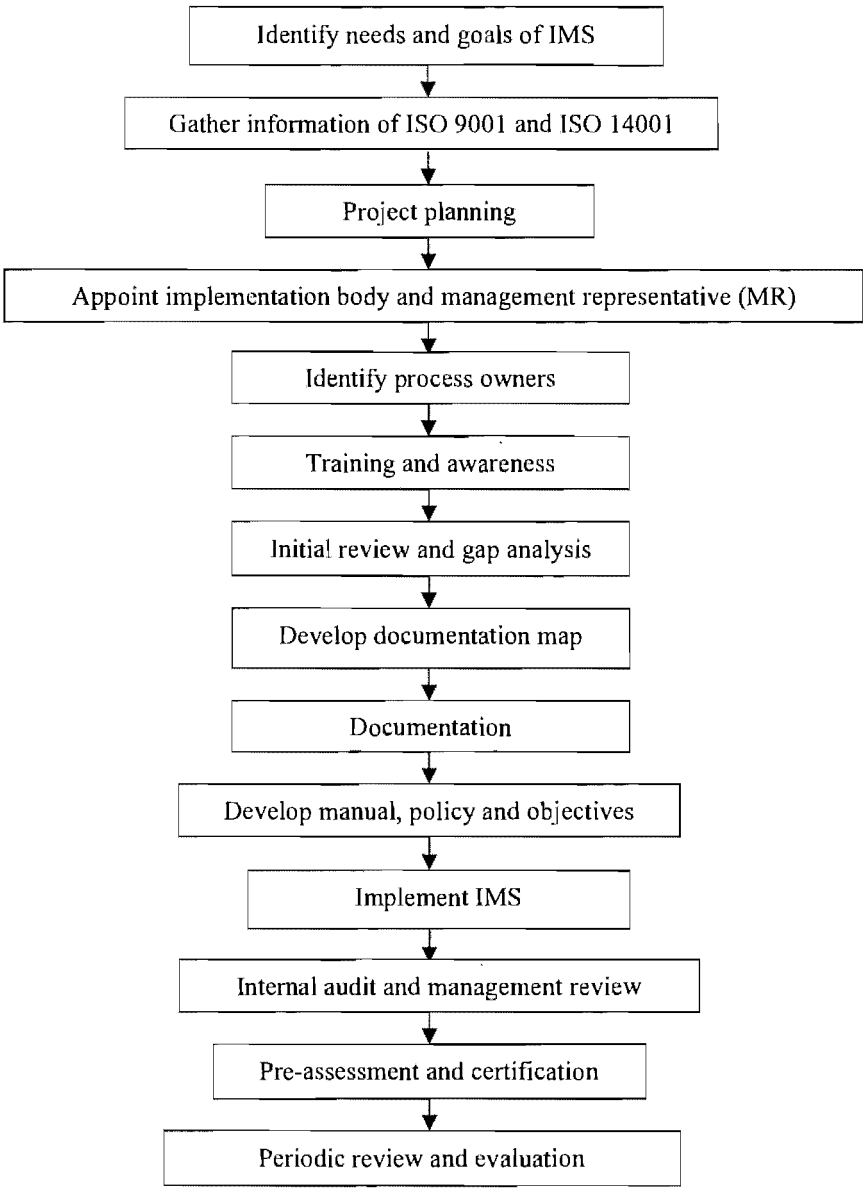

Figure 1. Flow chart of implementing integrated management system. This is a 14-step process of implementing integrated management system comprising of quality management system and environmental management system.

Implementing an integrated management system consists of a 14-step process. The steps of integration methodology are as follows:

1. Identify the needs and goals of implementing an integrated management system: This is the first stage of integration process where the goals and needs for integrated management systems are identified. The relevance of the management system to the organization is the most important aspect to be considered before opting for a particular management system. This is more like carrying an assessment where the top management justifies the significance of such integration and its probable outputs. Such assessments may include cost, time, human resources, operational considerations, certifications, legal and other requirements, and interests of external parties and stake holders. The benefits and drawbacks of implementing both systems together and separately are also discussed at this stage.
2. Gather information about the management system standards: At this stage, sufficient information regarding ISO 9001 and ISO 14001 is gathered. It is important to understand the criticality of the management standards, their applicability to the organization in particular, their peculiarities, and their periodic revisions. It is rather a challenging process to understand the requirements of each standard and interpret each clause to reflect the organizational needs accurately. In order to overcome all such challenges, adequate knowledge of both the standards and their requirements is essential.
3. Prepare project plan and communicate: At this stage, a project plan is prepared by developing a matrix chart comprising of key objectives, project activities, start and end time, responsibilities and project completion status and is communicated within the

organization. This matrix should be used to track the project progress and its performance on the time-line view.

4. Appoint an implementation body and a management representative: At this stage, the top management should form an integrated management system implementation team comprising of personnel of various competencies. In addition to that, a management representative overseeing the systems requirements besides regular responsibilities should be appointed. This representative acts as a liaison between the organization and external parties.
5. Identify process owners: At this stage, key personnel responsible for completing and implementing assigned processes are identified and declared owners of such processes. Process owners are responsible for leading the process team, generating necessary documents, and making necessary training arrangements for the other personnel working on the processes.
6. Provide necessary trainings and awareness: Adequate trainings for the personnel involved in the implementation of integrated management system should be provided. This should include trainings for internal auditors, documentation, document management and control, and record keeping. The training can be either formal or informal and should include every personnel including contractors, sub-contractors and haulers. There must be regular awareness training program from time to time so as to ensure that everybody in the organization is well aware of the management system and its importance.
7. Conduct initial review and gap analysis: The review of existing system within the organization is carried out and a gap analysis of the requirements with respect to ISO 9001 and ISO 14001 is conducted at this stage. This is done by analyzing element-by-

element of both the standards. The gap analysis helps in identifying which system elements are in place and which elements need to be developed or expanded so as to address the requirements of both the standards. Existing manuals, if any, can be used to identify gaps and overlaps in the system. Depending upon the importance and urgency of the identified gaps and other needs, priorities are assigned and process owners from the functional group of organization are listed accordingly. Aspects of business including core business function, environmental aspects and their impacts and other hazards are also identified at this stage.

8. Develop documentation map: At this stage, the list of documents and procedures required to comply with the requirements of quality and environmental management system is prepared. For this, the requirements of ISO 9001 and ISO 14001 are cross referenced and level 1, level 2, level 3 and level 4 documents corresponding to the elements of both standards are identified. Manual form level 1, procedures form level 2, work instruction form level 3, and records and forms form level 4 documents. The status of such identified documents is also displayed in the documentation map. The identified process owners of the functional groups are referenced in the documentation map so as to reflect their assigned responsibilities for implementing each system procedure.
9. Develop documentation: At this stage all the documents identified in the documentation map are created. Process owner are responsible for developing documents that are required at the site of work or work station. The printed form of procedures is made available at every work station and the electronic versions are maintained in the system. Documents addressing both standards are brought under a single documentation system

and are given document number accordingly. Figure 1 represents the document level in an integrated management system.

Figure 2. Integrated Document System

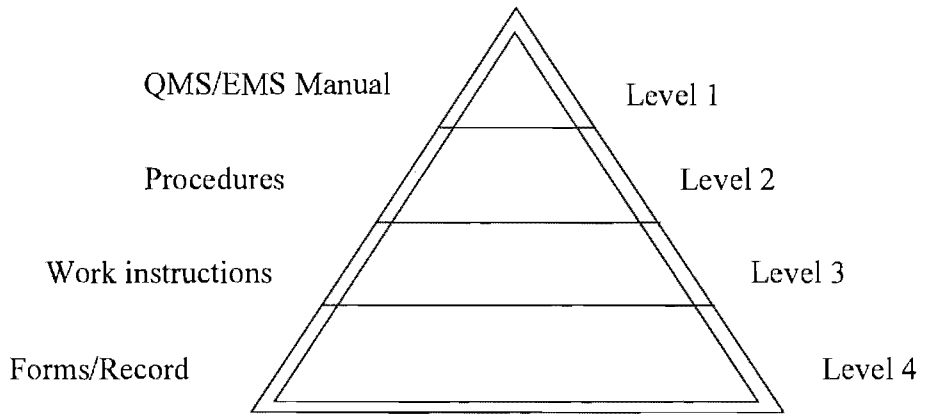

Figure 2. Integrated document system. This is an example of an integrated document management system

10. Develop integrated manual, draft policy and establish objectives: At this stage an integrated manual for the management system is developed. The manual should include all required procedures related to every aspect of operations, management, control and monitoring activities including the elements unique to each standard as well. A policy suitable to the organization and meeting the requirements of ISO 9001 and ISO 14001 standards is developed. The policy should include critical terms and address the requirements of each standard. Similarly, objectives and targets that are suitable to the operation of organization and consistent with the policy should be established.
11. Implement integrated management system: Identify the operational and process control need and implement management programs through the established procedures. This is a time taking process and should be done in stepwise fashion. This is actually based on

trial and error method where modifications are made to best fit the organizational needs without altering the integrity of the management system. The system is considered to be fully implemented when there are very minor changes to be made. There must be the system of corrective action and preventive action whenever there is deviation from the planned objectives or in case of any nonconformity in the system. Figure 3 represents the continual improvement model for integrated management system comprising of quality management system and environmental management system.

Figure 3. Continual Improvement Model of Integrated Management System

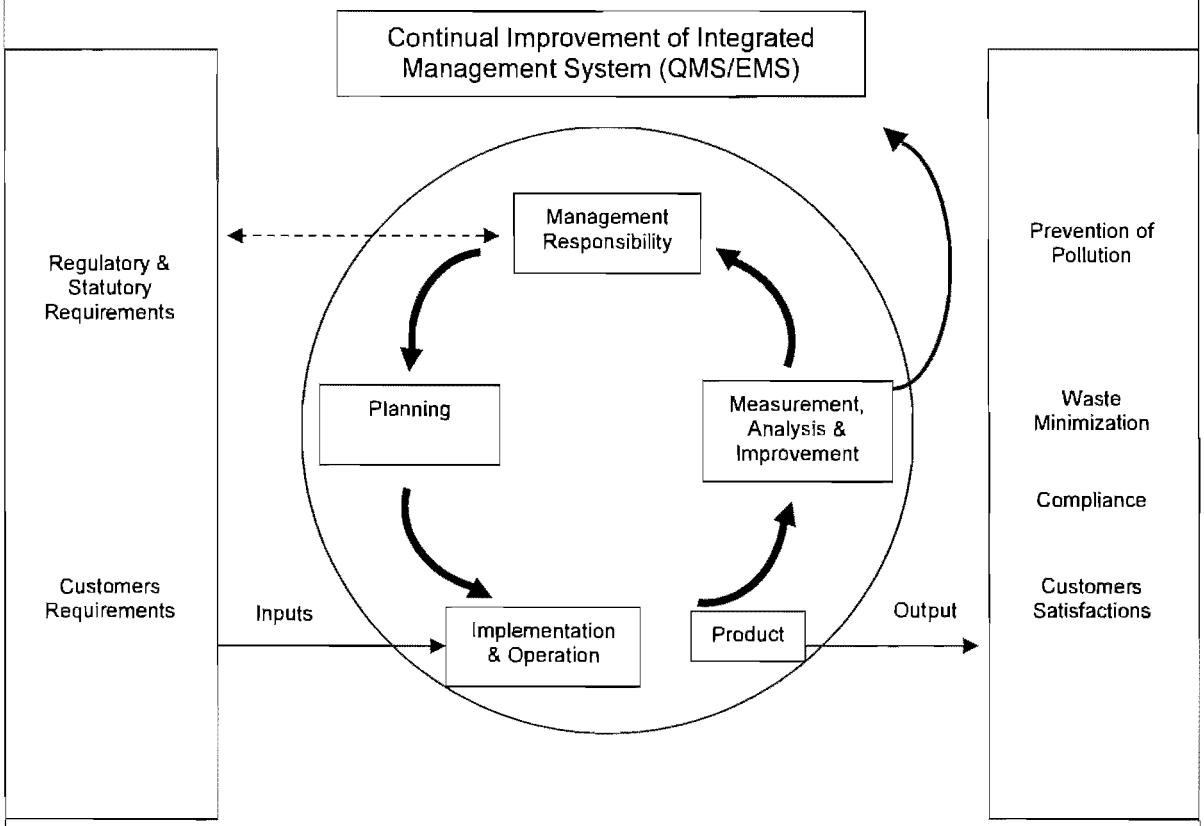

Figure 3. Integrated Management System Model. This is a continual improvement model of integrated management system comprising of quality and environmental management system.

12. Conduct internal audits and management reviews: Conduct internal audits after the implementation of integrated management system and identify any nonconformity within the system. The findings should be discussed in the management review meeting and respective corrective action and preventive action should be taken. Top management is required to review the suitability and effectiveness of the management system and assure continual improvement.
13. Pre-assessment and certification: Conduct pre-assessment of the system before third party audit. The nonconformities identified from the internal audit along with suggestions and findings should be treated as opportunity for improvement and respective corrective and preventive action should be implemented. The top management should review such actions and their effectiveness so as to ensure continual improvement. Apply for certification, if every requirement seems to have been met. Even though it is possible to implement integrated management system in an organization, it is not possible to get certification for the integrated management system separately. The certification can be obtained for either or both standards depending upon the organizational need.
14. Conduct periodic evaluation and reviews: After the successful certification, the organization should conduct periodic assessment and reviews to ensure the effectiveness and continual improvement of the integrated management system. The effectiveness of corrective and preventive action must also be assessed from time to time.

Factors Critical to Integrated Management System

There are few factors on which the success of the integrated management system hugely depends upon. The most important factor is the commitment of the top management which is the actual driver for the system. It is the top management whose willingness and assurance of

necessary resources for the system acts as a trigger for such an effort. The other factors are organizational culture, involvement of people and their support, personnel training and awareness, and customer communication. The success of an integrated management system should not be evaluated on its first time implementation but on its longevity and overall performance of organization.

Summary

This chapter discussed the findings of the current research. The elements of both the standards were categorized into essentially same elements, similar elements, elements unique to ISO 14001 and elements unique to ISO 9001. The majority of the elements of both standards were found to have similar requirements. The elements that were identified as unique to ISO 14001 showed some sort of correspondence to the elements of ISO 9001. The road map for implementing integrated management system and the similarities in most of the elements of ISO 9001 and ISO 14001 provided a basis of integration of quality management system and environmental management system.

Chapter V: Discussion

ISO 9001 and ISO 14001 are the most widely implemented international standards in the world. Implementing multiple management systems based on different ISO standards within an organization can be economically burdensome, time consuming and operationally complicated. As an attempt to integrate quality and environmental management systems into a single management system, a study of the common elements of ISO 9001 and ISO 14001 standards was conducted.

Limitations

As stated at the beginning, there were several limitations to this project which include company wise study of the project, comparison between the other systems that are already in place in the companies, interviews and interaction with the people involved in day to day activities and supplier and consumer perspective. These areas were not addressed due to constraints of resources, time and unavailability of ideal type of organization.

Conclusions

There is a possibility of integration of quality management system based on ISO 9001 and environmental management system based on ISO 14001. Most of the requirements of the standards are similar and there are overlaps of the requirements that make it possible for the integration of the management system. As long as the ISO certification of a particular standard is deemed of significance for an organization, the integration can be used as a tool to achieve desired certification. For those organizations which do not consider ISO certification as a major determinant of their business success, a full-fledged integration of the quality and environmental management system could be useful for their business excellence with a series of common elements addressing the requirements of both the systems.

Recommendations

Implementing an integrated management system within an organization is not an easy task. It is a long process and should be implemented in successive steps. Before implementing the integrated management system, the top management should show a commitment for such system and garner enough support from every employee in the organization. A preliminary review of the existing system including the gap analysis of the system requirements should be conducted prior to the start of implementation. The implementation should be followed by providing necessary trainings and developing a solid document system. In order to make an integrated management system successful, periodic review and continual improvement should always be given due preference.

Recommendations for Further Research

Further research could be done by implementing the integrated approach of the standards within an organization and finding the best fit of integration between the elements in the system. The integration of other management system can be studied with a similar approach of integration.

Reference

Badreddine, A., Romdhane, T. B., & Amor, N. B. (2009). A multi-objective approach to implement an integrated management system: Quality, security, environment. *World Congress on Engineering 2009 (volume1),* 75-81. Retrieved from EBSCO*host*

BusinessDictionalry.com (2010). Retrieved November 25, 2010 from http://www.businessdictionary.com

British Standards Institution Group. (2010). What are management systems? Retrieved November 25, 2010 from http://www.bsigroup.com/en/Assessment-and-certification-services/management-systems/at-a-glance/What-are-Management-Systems/

British Standards Institution Group. (2010). What is a standard? Retrieved November 25, 2010 http://www.bsigroup.com/en/Standards-and-Publications/About-standards/What-is-a-standard/

Block, M. R. (2000, July). Leveraging a quality system to establish an EMS. *Quality Progress*, *33*(7), 82. Retrieved November 15, 2010 from Academic Search Complete database.

Cianfrani, C. A., Tsiakals, J. J., & West, J. E. (Ed.). (2009). *ISO 9001:2008 Explained.* Milwaukee, WI: ASQ Quality Press.

Culley, W. C. (1996, August). Integrating ISO 14000 into your quality system. *Professional Safety*, *41*(8), Retrieved September 15, 2010 from Academic Search Complete database.

Environment Protection Agency. (2010). Tools for environmentally sound management. Retrieved November 30, 2010 http://www.epa.gov/wastes/conserve/materials/ecycling/conference/resource/guide-esm.pdf

Hartstern, R. F. (1997). ISO 14000 environmental management systems and its relationship to ISO 9000. *Proceedings of the ASQC's 51st Annual Quality Congress Proceedings*, Retrieved November 20, 2010 from http://asq.org/members/news/aqc/51_1997/10523.pdf

Hoyle, D (Ed.). (2006). *ISO 9000 Quality Systems Handbook*. UK: Butterworth-Heinemann

Hoyle, D (Ed.). (2008). *ISO 9000 Quality Systems Handbook*. UK: Butterworth-Heinemann

International Organization for Standardization. (2010). About ISO. Retrieved October 15, 2010, from http://www.iso.org/iso/about.htm

ISO. (2010). Discover ISO. Retrieved October 15, 2010, from http://www.iso.org/iso/about/discover-iso_the-scope-of-isos-work.htm

ISO. (2010). Discover ISO. Retrieved October 15, 2010, from http://www.iso.org/iso/about/discovers-iso_who-standards-benefits.htm

ISO. (2010). ISO 14000 Essentials. Retrieved October 15, 2010, from http://www.iso.org/iso/iso_14000_essentials

ISO. (2010). Stages of development of ISO standard Retrieved October 15, 2010, from http://www.iso.org/iso/standards_development/processes_and_procedures/stages_description.htm

ISO. (2010). Understand the basics. Retrieved October 15, 2010, from http://www.iso.org/iso/iso_catalogue/management_standards/management_system_basics

Jackson, S.L. (2001). Integrated management systems for business success. How to integrate ISO 9000and ISO 14000 systems. Retrieved November 20, 2010, from http://www.homestead.comliso1400I/1S0 14000IS09000integration.html

McDonald, M., Mors, T. A., & Phillips, A. (2003). Management system integration: Can it be done? *Quality Progress*, Retrieved from http://asq.org/data/subscriptions/qp/2003/1003/qp1003mcdonald

Renzi, M. F., & Cappelli, L. (2000). Integration between ISO 9000 and ISO 14000: Opportunities and limits. *Total Quality Management, 11*(4-6), S849-S856. Retrieved October 15, 2010 from ABI/INFORM Global. doi: 54855368

Spilka, M., Kania, A., & Nowosielski, R. (2009). Integration of management systems on the chosen example. *Journal of Achievements in Materials and Manufacturing Engineering, 35*(2), Retrieved September 25, 2010 from http://www.journalamme.org/papers_vol35_2/35213.pdf

Von Zharen, W.M. (2001). *ISO 14001: Positioning your organization for environmental success.* Rockville, MD: ABS Consulting Government Institutes.

Voorhees, J., & Woellner, R. A. (1998). *International environmental risk management: ISO 14000 and the systems approach.* Boka Raton, Fl: Lewis Publishers.

Whitelaw, K. (Ed.). (2004). *ISO 14001: Environmental system handbook.* UK. Butterworth-Heinemann

Zuckerman, A. (1997). *International standards desk reference*. New York: amacom.

Appendix A: Elements of ISO 9001:2008

Elements of ISO 9001:2008
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4.2 Documentation requirements
4.2.1 General
4.2.2 Quality Manual
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5.5.1 Responsibility and authority
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6.1 Provision of resources
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- 7.2.2 Review of requirements related to the product
- 7.2.3 Costumer communication

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- 7.3.1 Design and development planning
- 7.3.2 Design and development inputs
- 7.3.3 Design and development outputs
- 7.3.4 Design and development review
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- 7.3.7 Control of design and development changes

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- 7.4.1 Purchasing process
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- 7.5.3 Identification and traceability
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- 8.2.2 Internal audit
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Appendix B: Elements of ISO 14001:2004

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4 Environmental management system requirements
4.1 General requirements
4.2 Environmental policy
4.3 Planning
4.3.1 Environmental aspects
4.3.2 Legal and other requirements
4.3.3 Objectives, targets and programme(s)
4.4 Implementation and operation
4.4.1 Resources, roles, responsibility and authority
4.4.2 Competence, training and awareness
4.4.3 Communication
4.4.4 Documentation
4.4.5 Control of documents
4.4.6 Operational control
4.4.7 Emergency preparedness and control
4.5 Checking
4.5.1 Monitoring and measurement
4.5.2 Evaluation of compliance
4.5.3 Nonconformity, corrective action and preventive action
4.5.4 Control of records
4.5.5 Internal audit
4.6 Management review

Appendix C: Correspondence between ISO 14001:2004 and ISO 9001:2008

ISO 14001:2004		ISO 9001:2008	
Introduction			Introduction (title only)
		0.1	General
		0.2	Process approach
		0.3	Relationship with ISO 9004
		0.4	Compatibility with other management systems
Scope	1	1	Scope (title only)
		1.1	General
		1.2	Application
Normative references	2	2	Normative references
Terms and definition	3	3	Terms and definition
Environmental management system requirements (title only)	4	4	Quality management system (title only)
General requirements	4.1	4.1	General requirements
		5.5	Responsibility, authority and communication (title)
		5.5.1	Responsibility and authority
Environmental policy	4.2	5.1	Management commitment
		5.3	Quality policy
		8.5.1	Continual improvement
Planning (title only)	4.3	5.4	Planning (title only)
Environmental aspects	4.3.1	5.2	Customer focus
		7.2.1	Determination of requirements related to the product
		7.2.2	Review of requirements related to the product
Legal and other requirements	4.3.2	5.2	Customer focus
		7.2.1	Determination of requirements related to the product
Objectives, targets and programme(s)	4.3.3	5.4.1	Quality objectives
		5.4.2	Quality management system planning
		8.5.1	Continual improvement
Implementation and operation (title only)	4.4	7	Product realization (title only)
Resources, roles, responsibility and authority	4.4.1	5.1	Management commitment
		5.5.1	Responsibility and authority
		5.5.2	Management representative
		6.1	Provision of resources
		6.3	Infrastructure
Competence, training and awareness	4.4.2	6.2.1	(Human resources) General
		6.2.2	Competence, training and awareness

Communication	4.4.3	5.5.3	Internal communication
		7.2.3	Customer communication
Documentation	4.4.4	4.2.1	(Documentation requirements) General
Control of documents	4.4.5	4.2.3	Control of documents
Operational control	4.4.6	7.1	Planning of product realization
		7.2	Customer-related processes (title only)
		7.2.1	Determination of requirements related to the product
		7.2.2	Review of requirements related to the product
		7.3.1	Design and development planning
		7.3.2	Design and development inputs
		7.3.3	Design and development outputs
		7.3.4	Design and development review
		7.3.5	Design and development verification
		7.3.6	Design and development validation
		7.3.7	Control of design and development changes
		7.4.1	Purchasing process
		7.4.2	Purchasing information
		7.4.3	Verification of purchased product
		7.5	Production and service provision (title)
		7.5.1	Control of production and service provision
		7.5.2	Validation of processes for production and service provision
		7.5.5	Preservation of product
Emergency preparedness and response	4.4.7	8.3	Control of nonconforming product
Checking (title only)	4.5	8	Measurement, analysis and improvement (title only)
Monitoring and measurement	4.5.1	7.6	Control of monitoring and measuring equipment
		8.1	(Measurement, analysis and improvement) General
		8.2.3	Monitoring and measurement of processes
		8.2.4	Monitoring and measurement of product
		8.4	Analysis of data
Evaluation of compliance	4.5.2	8.2.3	Monitoring and measurement of processes

		8.2.4	Monitoring and measurement of product
Nonconformity, corrective action and preventive action	4.5.3	8.3	Control of nonconforming product
		8.4	Analysis of data
		8.5.2	Corrective action
		8.5.3	Preventive action
Control of records	4.5.4	4.2.4	Control of records
Internal audit	4.5.5	8.2.2	Internal audit
Management review	4.6	5.1	Management commitment
		5.6	Management review (title only)
		5.6.1	General
		5.6.2	Review input
		5.6.3	Review output
		8.5.1	Continual improvement

Appendix D: Correspondence between ISO 9001:2008 and ISO 14001:2004

Introduction (title only)			Introduction
General	0.1		
Process approach	0.2		
Relationship with ISO 9004	0.3		
Compatibility with other management systems	0.4		
Scope (title only)	1	1	Scope
General	1.1		
Application	1.2		
Normative references	2	2	Normative references
Terms and definitions	3	3	Terms and definitions
Quality management system (title only)	4	4	Environmental management system requirements (title only)
General requirements	4.1	4.1	General requirements
Documentation requirements (title only)	4.2		
General	4.2.1	4.4.4	Documentation
Quality manual	4.2.2		
Control of documents	4.2.3	4.4.5	Control of documents
Control of records	4.2.4	4.5.3	Control of records
Management responsibility (title only)	5		
Management commitment	5.1	4.2	Environmental policy
		4.4.1	Resources, roles, responsibilities and authority
Customer focus	5.2	4.3.1	Environmental aspects
		4.3.2	Legal and other requirements
		4.6	Management review
Quality policy	5.3	4.2	Environmental policy
Planning (title only)	5.4	4.3	Planning (title only)
Quality objectives	5.4.1	4.3.3	Objective, targets and programme(s)
Quality management system planning	5.4.2	4.3.3	Objective, targets and programme(s)
Responsibility, authority and communication (total only)	5.5		
Responsibility and authority	5.5.1	4.1	General requirements
		4.4.1	Resources, roles, responsibility and authority
Management representative	5.5.2	4.4.1	Resources, roles, responsibility and authority
International communication	5.5.3	4.4.3	Communication
Management review (title only)	5.6	4.6	Management review
General	5.6.1	4.6	Management review
Review input	5.6.2	4.6	Management review

Review output	5.6.3	4.6	Management review
Resource management (title only)	6		
Provision of resources	6.1	4.4.1	Resources, roles, responsibility and authority
Human resources (title only)	6.2		
General	6.2.1	4.4.2	Competence, training and awareness
Competence, training and awareness	6.2.2	4.4.2	Competence, training and awareness
Infrastructure	6.3	4.4.1	Resources, roles, responsibility and authority
Work environment	6.4		
Product realization (title only)	7	4.4	Implementation and operation (title only)
Planning of product realization	7.1	4.4.6	Operational control
Customer-related processes (title only)	7.2		
Determination of requirements related to the product	7.2.1	4.3.1	Environmental aspects
		4.3.2	Legal and other requirements
		4.4.6	Operational control
Review of requirements related to the product	7.2.2	4.3.1	Environmental aspects
		4.4.6	Operational control
Customer communication	7.2.3	4.4.3	Communication
Design and development (title only)	7.3		
Design and development planning	7.3.1	4.4.6	Operational control
Design and development inputs	7.3.2	4.4.6	Operational control
Design and development outputs	7.3.3	4.4.6	Operational control
Design and development review	7.3.4	4.4.6	Operational control
Design and development verification	7.3.5	4.4.6	Operational control
Design and development validation	7.3.6	4.4.6	Operational control
Control of design and development changes	7.3.7	4.4.6	Operational control
Purchasing (title only)	7.4		
Purchasing process	7.4.1	4.4.6	Operational control
Purchasing information	7.4.2	4.4.6	Operational control
Verification of purchased product	7.4.3	4.4.6	Operational control
Production and service provision (title only)	7.5		
Control of production and service provision	7.5.1	4.4.6	Operational control
Validation of processes for production and service provision	7.5.2	4.4.6	Operational control
Identification and traceability	7.5.3		
Customer property	7.5.4		
Preservation of product	7.5.5	4.4.6	Operational control
Control of monitoring and measuring equipment	7.6	4.5.1	Monitoring and measurement

Measurement, analysis and improvement (title only)	8	4.5	Checking (title only)
General	8.1	4.5.1	Monitoring and measurement
Customer satisfaction	8.2.1		
Internal audit	8.2.2	4.5.5	Internal audit
Monitoring and measuring processes	8.2.3	4.5.1	Monitoring and measurement
		4.5.2	Evaluation of compliance
Monitoring and measuring product	8.2.4	4.5.1	Monitoring and measurement
		4.5.2	Evaluation of compliance
Control of nonconforming product	8.3	4.4.7	Emergency preparedness and response
		4.5.3	Nonconformity, corrective action and preventive action
Analysis of data	8.4	4.5.1	Monitoring and measurement
Improvement (title only)	8.5		
Continual improvement	8.5.1	4.2	Environmental policy
		4.3.3	Objectives, targets and programme(s)
		4.6	Management review
Corrective action	8.5.2	4.5.3	Nonconformity, corrective action and preventive action
Preventive action	8.5.3	4.5.3	Nonconformity, corrective action and preventive action