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Working Group on Waste Prevention and Recycling

BARRIERS TO THE IMPLEMENTATION OF ENVIRONMENTALLY SOUND MANAGEMENT PRACTICES FOR SMALL AND MEDIUM SIZE METAL RECYCLING ENTERPRISES

Case Study: Canadian Ship Dismantling Enterprise

3rd Workshop on Environmentally Sound Management (ESM) of Wastes
Washington D.C., 20-22 March 2002

This paper was submitted to the Delegates of the Working Group on Waste Prevention and Recycling and participants to the 3rd Workshop on Environmentally Sound Management (ESM) of Wastes for consideration in March 2002.

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FOREWORD

At the second Workshop on Environmentally Sound Management of Wastes (ESM) in September 2000 considerable interest was expressed in an OECD framework that would enhance industry progress toward sustainable practices by emphasising the use of existing Environmental Management Systems (EMS), such as ISO 14 000 series and the European Eco-management and Audit Scheme (EMAS). It was recognised that EMS could play a role in promoting the application in practice of ESM guidance. However, it was emphasised that any ESM system making use of such EMS would also have to provide approaches that small and medium size enterprises (SMEs) could implement.

At the October 2001 meeting of the Working Group on Waste Prevention and Recycling an extended outline was provided concerning a study on "How to Apply ESM to small and medium size enterprises [ENV/EPOC/WGWPR/RD(2001)2]. The study is composed of three case studies and a synthesis report. Case studies look at car dismantling in the Netherlands, pre-treatment and recovery of electronics in Austria and dismantling of ships in Canada.

This case study on barriers to the implementation of environmentally sound management practices for small and medium size metal recycling enterprises focuses on a Canadian ship dismantling enterprise. The paper has been prepared by SENES Consultants Limited, Richmond Hill, Ontario, Canada. It provides an in-depth analysis on the possibilities of a ship dismantling enterprise to implement the ESM guidance developed for the OECD purposes. This version incorporates the comments from the Members of the ESM Steering Group.

Member countries recommended the declassification of this paper in December 2002. It is released on the responsibility of the Secretary General of the OECD.

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1. INTRODUCTION

SENES Consultants Limited was retained by Environment Canada to conduct a case study on the applicability of Environmentally Sound Management (ESM) practices to Small and Medium sized Enterprises (SMEs), and the factors that would influence the implementation of ESM. The ESM case study is based on the operations of the International Marine Group – Marine Recycling Corporation, a ship dismantling enterprise located in Port Colborne, Ontario, Canada. The study has been prepared for the purposes of the OECD's project on environmentally sound management of wastes (ESM).

1.1 Development of ESM

Environmentally Sound Management is a management system by which all practicable steps are taken to ensure hazardous waste or other types of waste are managed in a manner which would protect human health and the environment against the adverse effects that may result from such waste. The ESM system, developed by the Organisation for Economic Co-operation and Development (OECD), focuses on wastes and in particular recoverable wastes, and aims to develop high-level guidelines/standards to encourage sustainable development and achieve a more level playing field for ESM of wastes and used and scrap materials within the OECD countries. The scope and content of ESM is yet to be clarified. However, it is identified that the framework should focus on recovery and include both domestic and transboundary applications addressing hazardous and non-hazardous wastes and used and scrap materials.

Recently, the OECD Working Group on Waste Prevention and Recycling (WGWPR) has organized workshops to discuss the scope and future promotion of ESM for recoverable waste. It was felt that the scope of ESM should focus on the treatment and recovery installations as a priority and on application of core performance elements by these installations to ensure ESM of recoverable waste and used scrap materials.

There are two basic components that to date are to be included in the OECD ESM framework. The first component centres on promoting the use of existing Environmental Management Systems (EMS) such as ISO 14000 series and EMAS in enhancing industry's progress towards environmentally sustainable operations and practices. This is conducted while considering the limitations of Small and Medium size Enterprises (SMEs) with respect to implementation of such systems. The second component consists of the ESM guidelines/criteria, including "core performance elements" which are to be implemented in conjunction with the EMS. In support of developing ESM criteria for the treatment and recovery of wastes, the Working Group on Waste Prevention and Recovery (WGWPR) developed a draft document entitled *Core Performance Elements for the Environmentally Sound Management of Wastes and Used Scrap Materials* [ENV/EPOC/WGWPR(2001)4]. This document attempts to develop generic core performance elements that would be applicable for the evaluation of dismantling, refurbishing, pre-treatment, treatment and recovery facilities and provide the basis for ESM of recoverable wastes and used and scrap metals.

Until now, relatively little emphasis has been placed on the practical application of ESM by facilities involved in the recycling, treatment and disposal of hazardous wastes and hazardous recyclable materials. Many treatment and recovery facilities are small and medium enterprises (SME) that may require specific support in relation to the knowledge of environmental requirements, training, investment in innovative technology and implementation of ESM.

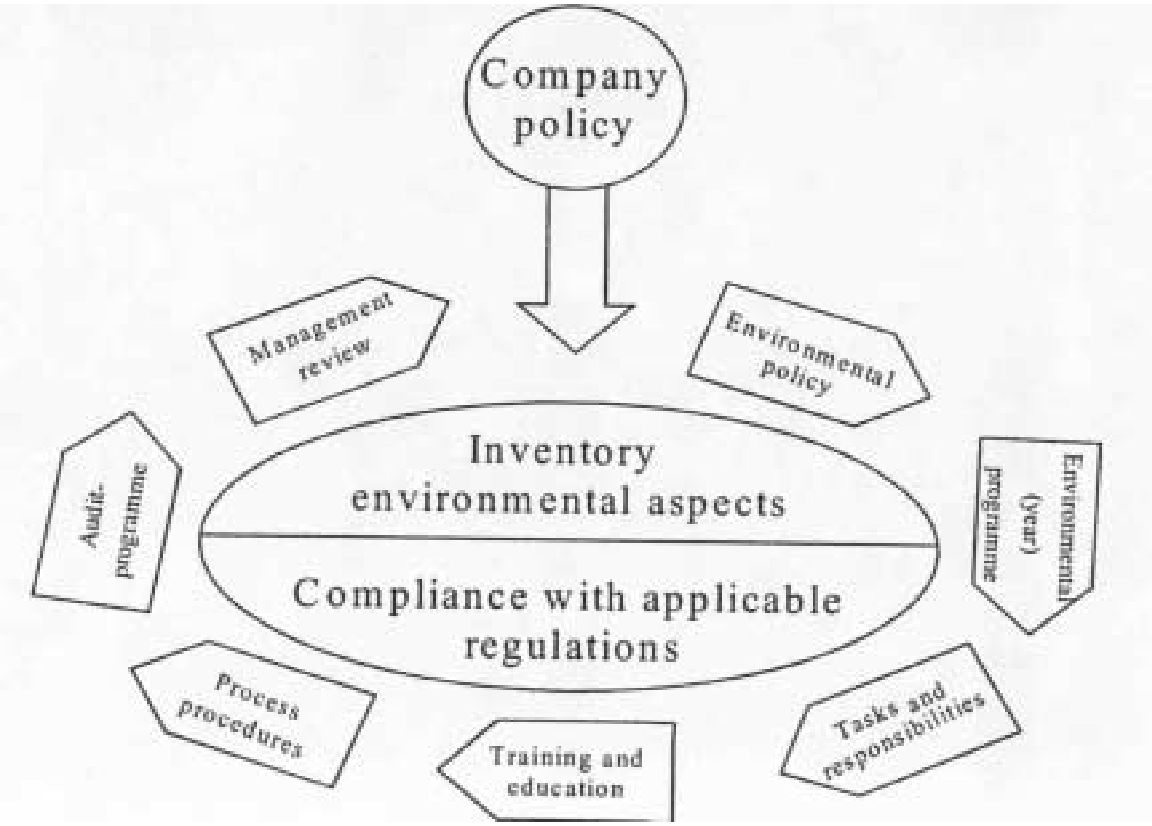
Although presently in progress of being further developed, the ESM core performance elements have been specifically designed to be generic in nature in order to be applicable to the management of all types of hazardous and non-hazardous wastes, covering collection, storage, re-use, recovery and disposal of residual materials. The ESM concept is aimed at the facility level, providing measurable expectations that should be incorporated into the normal operations of the organisations to improve the environmental performance and sustainability of operations. With the implementation of ESM guidelines within the OECD, it is expected that competing businesses would operate on a "level playing field" with respect to the environmental performance.

1.2 Applicability to SMEs

ESM core elements are consistent with current expectations for diligent environmental care within business operations. Where ESM principles apply on a broad scale to facilities, industrial sectors and government, facility level requirements can be generally met through the implementation of Environmental Management System (EMS). Even where an operation has not undertaken to subscribe to and obtain certification for a formalized EMS such as ISO 14001 or EMAS, the facility is able to achieve the expectations of the ESM core elements by undertaking reasonable measures for ensuring appropriate environmental performance and continual improvement toward improved environmental performance.

Various factors may influence an SME's ability to achieve the requirements of the core elements. These range from the corporate willingness to commit time and resources to environmental issues to external factors such as regulatory controls and enforcement. The assessment model identified in Figure 1 provides various EMS elements that classify the factors that influence ESM implementation. These factors are used in this case study to describe and understand the specific factors that may influence the ability of International Marine Group to satisfy the ESM expectations.

Figure 1



2. SCOPE AND OBJECTIVES

The objective of this document is to develop a case study on the applicability of Environmentally Sound Management (ESM) to a small ship dismantling operation, in order to assess the applicability of the ESM's core performance elements and the barriers that exist in implementation of such elements at the corporate level for similar SMEs. The focus of the case study is International Marine Group – Marine Recycling Corporation (MRC), a ship dismantling operation located in Port Colborne, Ontario, Canada.

The scope of the investigations undertaken in preparing the case study involved: the collection of general information on the mechanisms and instruments in place to support SMEs; the collection of specific information on how the ship dismantling sector implemented and managed environmental requirements and activities with reference to influencing factors; assessing the ESM core elements against the operations and management of MRC including the level of difficulty and any barriers to implementation, and analyzing the information gathered in order to identify key factors of success or failure, problems or needs of SMEs and measures to enhance ESM implementation.

2.1 Methodology & Organisation of The Report

2.1.1 Methodology

The approach for collection of information relevant to this case study involved the review of industry data available through various public sources, interviews with MRC and other industry contacts, review of MRC environmental management documents and inspection of the operations.

Site visits was conducted on November 29th and December 4th, 2001 by SENES staff in order to gather information about the EMS presently in place and its implementation process. During the site visit, the year-end EMS management meeting was attended in which various aspects of EMS and its implementations and non-conformities were discussed in detail and preventive / corrective measures were recorded as future action items.

In addition, a comprehensive tour of the shipyard was conducted during which spill response equipment, fire extinguishers and the Emergency Response Guide was observed. Workplace practices were observed and reference documents were collected for review.

2.1.2 Report Organisation

In this report, national and international data, including economic data on ship dismantling operations, are discussed followed by discussions about the case study: International Marine Group – Marine Recycling Corporation, and assessment of core performance elements of ESM as it pertains to the case study. As a part of the assessment, the factors influencing the success or failure of implementing ESM core elements are discussed. In conclusion, various factors influencing the success or failure of ESM implementation are discussed and some corrective actions are suggested.

3. KEY ECONOMIC DATA

3.1 National Data

According to Canadian Economic Indicators, the gross domestic product (GDP) for the third quarter of 2001 stands at $1,077.70 billion CDN ($673.60 billion US), and the real gross domestic product (RGDP) for the same period stands at $1,022.9 billion CDN ($639.3 billion US). The Growth in the RGDP averaged 4.7% for the year 2000, which was similar to that of 1999 (Statistics Canada, 2001).

The waste management industry is classified under the environmental group of industries with a revenue contribution of 21.3% to this sector, as per 1998. The Waste Management and Remediation Services industry posted 1998 environmental revenues of $ 3.0 billion CDN ($1.9 billion US), practically matching those of the Wholesale Trade industry. Being a more homogeneous industry, Waste Management and Remediation Services undoubtedly derives a significantly larger portion of its total revenues from environment-related activities relative to all other industries. Most establishments in this industry specialize in one category of environmental services rather than providing multiple types of services (Statistics Canada, 1998).

In terms of size distribution, on overall scale, at the end of 1999 early 2000, about 75% of Canadian enterprises were classified as small, with annual operating revenues less than $ 5 million CDN ($3.1 million US), while about 5% were classified as large, with operating revenue exceeding $ 75 million

CDN ($47 million US) per year. The remaining enterprises (20%) were classified as medium, with operating revenues ranging from $5 to $75 million CDN ($3.1 to $47 million US). In the Environmental Goods and Services sector, as per 1998, there were 6,294 business establishments engaged, in whole or in part, in environment-related activities. Small establishments made up 96% of all establishments in the Canadian environment industry and accounted for 41% of total employment (Statistics Canada, 1998).

3.2 Mechanisms and Instruments in Place to Support SMEs

SMEs in Canada are supported through various industry associations and chambers of commerce. These groups provide information sharing opportunities and shared services that allow SMEs to gain some of the advantages available to larger organisations such as group insurance. The SMEs together in associations are also more organised for submitting comments and concerns to government agencies on proposed regulations, policy, etc.

Government financial support programs also exist for selected priority industries or initiatives that correspond to the government's current policy and financial budget. These programs range from industry to industry and change over time depending upon economic conditions and the government's plan to stimulate specific regions of the country or sectors of the economy.

A mature business culture also provides supporting features such as a stable and government-backed insurance system, public health care and financial support for the unemployed, injured, handicapped and the retired. While these instruments may not serve as direct supporting features for SMEs, they create a business climate that enables SMEs to be created and exist, removing some of the businesses risks that might otherwise influence operations.

3.3 Data on Ship Dismantling Sector

Currently there are a handful of establishments worldwide that are involved in dismantling of large vessels. The ship dismantling industry has established a strong presence in several Asian developing countries, which also provide markets for the recycled parts and materials. India breaks 42% of the vessels that are dismantled every year, Bangladesh 7%, Pakistan 6%, China 4%, and the rest of the world 41% (UNEP, 2001). In Canada there is only one active dismantling facility whose single function is the breaking of ships. As world trade expands so does the global shipping fleet. It is estimated that 500-700 merchant vessels, including oil tankers and cargo ships, will be scrapped annually over the next 15 years. The average age of the cargo-carrying fleet is now 18 years, compared to an average scrapping age of 25-26 years.

The single most important factor affecting the ship dismantling industry is the price of scrap steel. Most cargo ships are composed of approximately 80-90% steel, which is sold as scrap metal for reprocessing. Therefore, the ship dismantling industry is dependent on the price of scrap steel. Other valuable ship components, such as engines, electrical equipment, furniture, pumps and valves, and much more can also be profitably recycled. The vessels that are to be dismantled are sold to ship-breaking companies based on the scrap value that they hold at the time of sale. Once purchased, the ship dismantling company, based on scrap-steel market value, the cost of towing and ship breaking (including cost of waste disposal, equipment, etc.), availability of personnel and workspace and needs of the company, decide to commence the breaking or delay the dismantling.

In Canada, the vessels destined for dismantling are both government owned and commercial. The Canadian government owned (crown assets) vessels that are destined for dismantling are evaluated based on market value of scrap steel and then sold to the open market. Commercial vessels, which are

mostly owned by the shipping companies located within the Great Lakes region, are sold also according to the market values of scrap steel. However, the biding process is limited due to networking with the local dismantling community.

3.4 Case Study: Marine Recycling Corporation (MRC)

MRC operates a ship breaking facility located on the north shore of one of the Greta Lakes, Lake Erie, at the mouth of the south portion of the Welland Ship Canal. The site is located on federal lands, leased from St. Lawrence Seaway, a Canadian Crown Corporation. MRC is one of the three entities of International Marine Group (IMG), the other two being Raw Material Company, which is involved in waste storage and processing and International Marine Salvage, which is engaged in ferrous and non-ferrous metal recycling operations.

MRC dismantles, on an average, 2 vessels per year. MRC purchase vessels primarily from shipping companies in the Great Lakes region and occasionally bids on Crown-owned vessels destined for disposal. MRC can be classified as a micro enterprise due to the fat that although the administrative area remains constant with a staff of 2, the number of employees directly working towards the dismantling of ships will vary depending on the price of steel and availability of ships ready for dismantling. Although different employees will perform specific functions at different stages in the ship dismantling process, MRC has on site 2 to 5 employees.

4. KEY ENVIRONMENTAL DATA FOR SHIP DISMANTLING SECTOR

The decommissioning of large ships may involve the removal of many tonnes of hazardous wastes, including; Persistent Organic Pollutants (POPs) such as PCBs, heavy metals such as mercury and lead, asbestos, oil and gas, prior to dismantling. The ship dismantling process can also result in the release of dioxin and sulphur fumes. Workers, local communities, coastal and ocean biodiversity, groundwater and air are all at risk.

Outside of ship dismantling, the only other alternative commonly considered for vessels disposal is sinking for recreational or reef development purposes.

4.1 Ship Dismantling

Ship dismantling is possibly the preferred disposal option as it provides the best potential for resource recovery, minimisation of waste and reduction/elimination of possible environmental impacts associated with wastes and used materials on board vessels. Many of the vessels currently designated for scrapping were built in the 1940s, 1950s, and 1960s using what was then state-of-the-art material in their construction. Many of these materials are currently classified as hazardous, including, but not limited to asbestos, PCBs, lead, chromates, mercury, and cadmium.

There are some less visible technical issues that are specific to the ship dismantling operations, which could have potential impacts on the environment. For example, rainfall that accumulates inside ships that are being dismantled is normally pumped and released on land or into the adjacent water body. The rainwater/snowmelt may be contaminated with residual contaminants and its direct discharge to surrounding environment may not be an environmentally responsible practice. Such vaguely defined operations are a challenge for both the ship dismantling sector and regulators.

Ship dismantling provides a mechanism for the collection and appropriate management of hazardous wastes contained within vessels and provides a process in which other individual recoverable materials and wastes can be segregated and collected for appropriate management. The overall material reuse/recycling rate for the vessel dismantling process is above 99%. This value is driven mainly by the weight of metal recycled and the relatively small amount of wastes requiring disposal. The Canadian experience in the ship scrapping process, typically occurs in a series of steps described below:

1. **Survey of the ship:**
   In conducting a survey of the vessel a diagram of all rooms, compartments, tanks, and storage areas is used (or prepared if not available) to identify areas that may contain hazardous materials and hazardous waste. A preliminary sampling of media is conducted prior to starting the dismantling operation.

2. **Removal of liquids:**
   The removal of liquids such as fuels, oils, antifreeze, bilge, ballast water, etc. from the ship generally occurs throughout the ship scrapping process. Upon identification of types of liquids on board of ships, proper procedures are used for removal and safe disposal or reuse of such materials. During the ship scrapping process, water will continue to accumulate (from rain and leaks) and will have to be removed. This water may be a continuous source of local contamination.

3. **Removal of equipment:**
   Initially smaller equipments such as fixtures, anchors, chains, etc. are removed. Large reusable components (e.g., engine and their parts) are removed as they become accessible. Reusable materials and equipment may be sold directly with little or no refurbishment by the scrapping facility. Propellers may also be removed so the hulk may be more easily manipulated into shallow water.

4. **Removal and disposal of asbestos and PCBs**
   Asbestos-containing material is removed from cut lines so that large sections of the ship can be removed. The engine rooms usually contain the most asbestos and, therefore, take the longest for asbestos removal to be complete. PCB-containing materials that are accessible are removed, as well as PCB-containing materials from areas to be cut. Some PCB-containing materials may be left in place on the room-sized pieces, only to be removed after the large pieces are moved to shore, where the removal process is easier.

5. **Surface Preparation:**
   Paint is removed, if required, prior to cutting. The presence of hard-to-remove and potentially toxic materials may require specific cut-line preparation, such as grit blasting.

6. **Cutting:**
   During the metal cutting phase, the upper decks and the superstructure and systems are first cut, followed by the main deck and lower decks. Metal cutting is typically done manually using oxygen-fuel cutting torches, but may be done with shears or saws (for nonferrous metals). Typically, as large parts of the ship are cut away, they are lifted by crane to the adjacent ground where they are cut to specific shapes and sizes required by the foundry or smelter to which the scrap is shipped. As cutting continues and the weight of the structure is reduced, the remaining ship hulk floats higher, exposing lower regions of the hull. Ultimately, the remaining portion of the hull is pulled ashore and cut.

7. **Recycle or disposal of materials:**
   Scrap metals, including steel, aluminium, copper, copper nickel alloy, and lesser amounts of other metals, are sorted by grade and composition and sold to re-melting firms or to scrap metal brokers. Valuable metals, such as copper in electric cable, that are mixed with non-metal material may be recovered using shredders and separators in on or off site secondary operations.

The ship dismantling industry in North America is relatively small vis-à-vis the global market. Consequently, professional organisations do not exist that would assist the companies in dealing with environmental issues specific to their operations. Training and information sharing is generally conducted at the tradesmen level. The workers in this business are highly skilled in torch cutting, ship dismantling procedures and safe work practices. Environmental awareness is an additional training area in which workers are required to participate.

Ship dismantling in Canada is a mature industry having essentially no recent technological innovations that have substantially changed the approach to the business. In general, this industry is treated the same as other SMEs with respect to taxes, levies and subsidies. Business and property taxes are based on profit and property size and location. Levies depend on the services required of the government. The provincial government of Ontario imposes user fees to obtain environmental approvals and authorisations. New Provincial government environmental programs may impose fees on generators and transporters of hazardous waste to support the government tracking of hazardous waste streams.

4.2 The Environmental Status of The Case Study: MRC

The IMG group of companies has been ISO 14001 certified since December 2000. This Environmental Management System (EMS) encompasses operations for all the three entities. The focus of this case study is however on the operations associated with MRC, and thus only the relevant information has been presented in this report. The key to the EMS is the company's environmental policy, which outlines the company's outlook on the environmentally related aspects. This policy is annually reviewed in year-end management meetings at which point necessary amendments to the policy are made in accordance to updates to relevant legislation and regulatory guidelines.

5. IMPLEMENTATION OF ESM CORE PERFORMANCE ELEMENTS

The following discusses each of the ESM core performance elements, with respect to their applicability to International Marine Group – Marine Recycling Corporation (MRC), the status of current activities and environmental management at MRC, and the level of difficulty and barriers to the implementation of ESM practices.

5.1 The Facility Should be Appropriately Authorized/Permitted/Licensed on Adverse Environmental Effects.

5.1.1 Applicability

Recognising that most of the core performance elements are aimed for implementation at the facility level, this element is controlled by the regulatory agencies for the jurisdiction. The operations of MRC are regulated and subject to enforcement by Federal, Provincial and Municipal regulators in Canada. The following list provides an overview of the regulatory structure applicable to the operation:

5.1.2 Provincial Statutes:

- Environmental Protection Act
  - Reg. 347, General - Waste Management Regulation
  - Reg. 346, General - Air Pollution Regulation
  - Reg. 362, Waste Management - PCBs
  - Reg. 356, Ozone Depleting Substances - General Regulation
  - Reg. 102/94, Waste Audits and Waste Reduction Work Plans
  - Reg. 103/94, Industrial, Commercial and Institutional Source Separation Programs
  - Reg. 189/94, Refrigerants Regulation
  - Reg. 413/94, Halon Extinguishing Equipment
  - Reg. 717/94, Solvents Regulation
  - Reg. 675/98, Classification and Exemption of Spills
  - Reg. 127/01, Airborne Contaminant Discharge Monitoring and Reporting Regulation

- Ontario Water Resources Act

- Reg. 329, Fuel Oil Code, under the Energy Act

- Dangerous Goods Transportation Act
  - Reg. 261, General Regulation

- Gasoline Handling Regulation
  - Liquid Fuels Handling Code

- Pesticide Act
  - Reg. 914, General Regulation

5.1.3 Federal Statutes

- Canadian Environmental Protection Act
  - SOR/91-152, Chlorobiphenyls Regulations
  - SOR/92-507, Storage of PCB Material Regulations
  - SOR/92-637, Export and Import of Hazardous Waste Regulations
  - SOR/94-260, New Substances Notification Regulations
  - SOR/99-7, Ozone Depleting Substances Regulations
  - SOR/99-255, Federal Halocarbon Regulations
  - Notices With Respect to National Pollutant Release Inventory (NPRI)

- Transportation of Dangerous Goods Act, 1992
  - SOR/85-77, Transportation of Dangerous Goods Regulations

- Atomic Energy Control Act (e.g., for radioisotopes)

- Hazardous Products Act
  - SOR/88-66, Controlled Products Regulation

5.1.4 Municipal Requirements

- Local Sewer-Use By-law, Solid Waste Disposal Restrictions and Noise By-laws

5.1.4.1 Status

The International Marine Group maintains a procedure to identify and have access to legal and other requirements to which the organisation subscribes, such as voluntary guidelines and corporate requirements, and that are applicable to the environmental aspects of its activities, products and services. The existing ISO 14001 EMS manual (Section 1: Policy & Procedure, subsection 4.3.2: Legal & Other Requirements) lists all the legislation / regulatory requirements that apply to each of the three entities of IMG, namely IMS, RMC and MRC.

IMG has subscribed to environmental tracking services, which provides the company with an overview of current and future legislation. A list of subscriptions, newsletters & publications and memberships that IMG uses to track legal requirements are presented in Appendix A. The Canadian Environmental Regulation Compliance News (CERC News) newsletter is circulated to members of the ISO sub-committee and other administration staff for review. Reviewers will sign the distribution form for each issue, indicting their acknowledgement of reviewing that issue. In case there are changes to applicable legislation, appropriate staff is directed to obtain the related information for further review. The environmental staff then discusses and reviews the new or amended legislation to assess its applicability to all activities, products or services with respect to the environmental aspects and potential impacts associated with them. If required, the text of the new or amended legislation is obtained from the government printing office, and changes to existing internal documents are completed. A "document control" form is used to keep track of the changes and the effective date.

In addition, the Environmental Management Representative (EMR) for IMG reviews the list of applicable legislation / regulation annually against the current lists of Environmental Aspects and Impacts and reports its findings at annual management review meetings. The EMR then revises and amends the tasks associated with the compliance issue. Facility changes are identified by the EMR through regularly scheduled site inspections, administration meetings, through the activities of the Health & Safety Committee, and document review.

MRC also retains a third party auditor to conduct an environmental compliance audit on annual bases, for all the three entities of IMG.

5.1.4.2 Barriers

The existing regulatory infrastructure and enforcement in MRC's jurisdiction appears to be adequate in ensuring environmentally sound management of on site operations. MRC has no direct control of regulations or laws being promulgated by the various authorities and can only provide stakeholder inputs in the development of newer legislation's.

Identification and tracking of applicable legal requirements by the operation is necessary to maintain compliance. Numerous information sources and associations exist in this jurisdiction to facilitate regulatory tracking, but time must be spent to review the information or participate in the association meetings. There is also a need for an underlying understanding of regulations and how they may apply to the operations of the facility. These requirements did not pose a challenge to MRC, but depending upon the available resources and competency of the staff at other SMEs, they may present a great challenge.

5.2 The Facility Should Have Taken the Appropriate Measures to Ensure that Requirements for Occupational Health and Safety are Met.

5.2.1 Applicability

Numerous federal and provincial acts and regulations, municipal permits and by-laws apply to the MRC operation which in general are intended to reduce emissions and the impact to human health and the environment as a whole. Some of this legislation includes requirements to obtain authorisation to operate, create and transport wastes, release air emissions, among other requirements. The authorisations also may carry site-specific operating conditions and requirements.

5.2.2 Status

Marine Recycling Corporation is located on federal land, owned by the St. Lawrence Seaway. The site is registered with the provincial Ministry of Environment for the generation of hazardous and liquid industrial wastes. This registration specifies the types of waste, generation method, estimated generation rate and planned disposal or management options that have been registered with the government. Additional notification to the provincial government is required to include new types of waste or new waste streams of a similar waste.

The facility is considered to be a waste management facility under provincial regulations and requires approval from the Provincial government to operate. The approval document includes conditions to guide operations that are deemed to be important by regulators to control environmental impacts.

Some materials and wastes are considered Dangerous Goods by the Federal government. The transport of these regulated materials must follow the requirements specified in Transportation of Dangerous Goods Act and regulations. This legislation includes requirements for regular training for individuals involved in the handling and transport of these materials.

In terms of atmospheric emissions, air emissions from a waste facility would generally require the authorisation of the provincial government. An application process is followed to demonstrate that no unacceptable impacts will occur as a result of the emissions. The fumes generated outdoors that are associated with torch cutting operations are not considered by the Provincial Ministry of Environment as being applicable to the permit requirements.

Health and safety requirements do not include any specific authorisation, but work conditions must meet the appropriate conditions as specified by the provincial regulations. Formal mechanisms are required within the organisation so that health and safety concerns may be communicated from the employees to management. Health and safety committees meet, conduct inspections and make recommendations to improve work conditions.

5.2.3 Barriers

Generally, appropriate authorisation through permits or approvals are not difficult to obtain provided the necessary administrative details and assessment have been completed to demonstrate that potential environmental impacts are managed at an acceptable level. User fees do exist in the permitting process for some authorisations. These are based on an estimate of the time necessary to review the permitting documentation. For approval for air emissions, these fees may range from several hundred

Canadian dollars to a few thousand dollars, depending on the complexity of the application. As these fees increase, they present an increased barrier to SMEs, especially any with low revenue streams.

Another potential barrier is similar to the barrier discussed for regulatory compliance. There is an underlying need for the facility to understand the permitting requirements and situations in which they become applicable to the operations. Those SMEs that lack staff that are competent in such areas will require external assistance to identify when and what appropriate authorisations are required.

5.3 The Facility Shall Have a Waste Minimization Concept

5.3.1 Applicability

The ship dismantling industry is based on waste recovery as its prime motive. Hence waste minimisation is directly linked to maximising profitability of the business in this sector.

5.3.2 Status

The International Marine Group – Marine Recycling Corporation has stated in their environmental policy a commitment to Waste Management, *to reduce waste generation, manage waste material in a manner that eliminates the potential for environmental contamination, and divert material from landfills.* Unlike organisations that store ships and sink them to create recreational attractions or to build reefs, MRC is committed to maximising the recovery of the scrap metal and other reusable machineries on board of decommissioned vessels. In terms of other types of wastes generated in the ship dismantling operation, due to economic advantages as well as the environmental responsiveness of the company, effort is aimed at maximising recycle/reuse of non-metallic materials on board. For example, the hydrocarbons on board of a vessel (e.g. hydraulic oil, bunker C oil, fuel oil, etc.) are removed from the vessels and are either sent directly for use at other facilities (e.g. as a combustion source) or sent to oil/hydrocarbon refining/recycling facilities to reclaim the useful fraction.

MRC also selects the ships which are best suited to recycling to minimise waste generation on their site. Generally, the operation is best suited to the collection and reselling of steel for recycling. Ships, such as cargo carriers are mainly steel and have relatively little other materials that would require disposal. Passenger ships however, have much more material that is not easily recovered or reused. MRC selectively bids on ships or modifies its bid to target the ships that are best suited to its operations. Some international ship dismantlers operate in market conditions that provides advantages to manage the miscellaneous materials such as furniture and floor coverings.

5.3.3 Barriers

There are no identified barriers to committing to the concept of waste minimization. The degree to which an SME will be able to implement waste minimisation will depend on the local economy in which the facility operates.

5.4 The Facility Shall be Appropriately Certified Under an Applicable Environmental Management System (EMS)

5.4.1 Applicability

The operations of ship dismantlers are appropriate for application of Environmental Management Systems (EMS). The potential exists to create significant environmental impacts that can be managed through an effectively developed and maintained EMS.

5.4.2 Status

The Marine Recycling Corporation has been ISO 14001 certified since December of 2000. An Environmental Management System (EMS) manual encompasses all three entities of the International Marine Group (IMG), including operations, services and productions. Despite the cost involved, the EMS undergoes annual audits by a third party auditor for an independent verification of the EMS. There are daily, weekly and monthly inspections in order to confirm compliance. The frequency of the inspections depends on the severity of the impact that an operation or an activity can have on the environment and on human health and safety. In addition to quick response to possible non-conformances through discussions in ISO sub-committee meetings and an immediate response program, any non-conformities are discussed in details during the annual management meeting, and preventive measures are developed and initiated to avoid recurrence.

It is due to the existence of a complete facility EMS, such as ISO 14000, that this ESM core performance requirement is satisfied.

5.4.3 Barriers

The major barrier to ISO 14001 certification is the cost of implementation and maintenance of the system. Generally, SMEs will require external assistance from a consultant to proceed through the implementation process. This creates an external cost in the tens of thousands of dollars ($20,000 - $40,000 CDN, $12,500 - $25,000 US) prior to registration. Independent verification and registration of the EMS to ISO 14001 will cost several thousands of dollars ($6,000 - $10,000 CDN, $3,750 – $6,250 US) over a three-year cycle. This verification and registration cost recurs over subsequent three-year cycles. Internal costs in support of EMS maintenance will likely be more significant. While internal staff time can be rationalised to be paid for regardless of the task performed, the added burden of EMS development, implementation, and training takes available resources away from core activities, which will result in reduced productivity or a requirement for additional staff. Internal costs may accumulate in the range of $50,000 to $100,000 CDN ($31,000 – $62,500 US) over the EMS development process depending upon the complexity of the EMS, the site operations and number of staff employed. Maintaining an EMS also requires regular staff resources.

Typically, there are significant financial burdens faced by SMEs to develop, implement and maintain an EMS that would be sufficient to satisfy ISO14001. The development and implementation of ESM will have to be sensitive to the financial limitations faced by SMEs in implementing ESM.

5.5 The Facility Shall Have an Appropriate Operative Monitoring and Reporting Programme

5.5.1 Applicability

The facility has a number of objectives and targets that require monitoring and reporting in order to monitor performance. Also regulatory compliance requirements are applicable for monitoring and reporting that allow for corrective action to be undertaken if non-compliance situations develop.

5.5.2 Status

The International Marine Group has established procedures to monitor and measure, on a regular basis, objectivities, targets and other parameters of its operations and activities that pertain to environmental aspects. An environmental management program or work instruction has been developed for those operations and activities that require operational control. The procedures are intended to evaluate compliance with relevant environmental legislation and regulations. The monitoring results are documented and reviewed annually to monitor the environmental performance of the company. Depending on the nature of the non-conformity found through monitoring of operations and activities, managerial decisions are made to rectify and prevent future occurrence. Operations or activities that are associated with significant environmental aspects and/or workers health and safety are closely monitored.

5.5.3 Barriers

No substantial barriers or difficulties exist with respect to monitoring and reporting. Once relevant parameters are selected for monitoring and indicators/criteria are set against which the monitoring results can be compared, the reporting of monitoring results is a common industrial practice.

5.6 The Facility Shall Have an Operative Inspection and Recording Program for all Input and Output Materials

5.6.1 Applicability

The facility has an opportunity to inspect the ships prior to acceptance; however, it is not possible to record detailed data on input materials. The first opportunity to record these data is during dismantling and the creation of outgoing material.

5.6.2 Status

A weigh scale is used to keep a record of recyclable materials and hazardous waste leaving the ship dismantling site. The transport vehicles are weighed before entering the shipyard as well as when leaving. Scale calibration performed quarterly and a copy of the calibration procedure and the calibration certificate are filed according to company's Document Control and Records. The transport of hazardous wastes removed from vessels are conducted under the requirements of the Canadian Transportation of Dangerous Goods Act and Ontario Waste Management Regulation. The transport trucks and containers are properly labelled and quantities are tracked on waste manifests and shipping documents.

The quantification of input materials for the Marine Recycling Corporation is based on the engineering specifications of the vessel. Although a majority of the weight is from the metallic part of the vessels, there are quantities of other types of materials, including hazardous wastes, that may not be captured on ship specifications and need to be identified and quantified by other means. Therefore, prior to dismantling vessels are inspected for hazardous wastes (e.g. asbestos, PCBs, hydrocarbons, etc.), and the amount is estimated to prepare for safe removal of such wastes from the vessels. An understanding as to the types and quantities of materials contained within a ship structure is obtained from professional judgement and historical knowledge of similar ships.

5.6.3 Barriers

Input materials are generally not recorded at a detailed level. Information of specific quantities of each type of material may not exist until the ship dismantling process is undertaken. Generalised estimates and inspections provide sufficient information for appropriate planning for material management planning. Specific quantity tracking is achieved upon removal of the materials from the ship carcass, but material balances are not feasible due to approximated quantities at time of dismantling. This condition is expected to be true for most SMEs involved in assembled or mixed waste material handling and recovery.

5.7 The Facility Shall Have Appropriate House and Record Keeping

5.7.1 Applicability

For the control of potential environmental impacts and safety hazards, good housekeeping must be maintained. Controlled record keeping is essential to demonstrating that environmental performance measures have been implemented and maintained.

5.7.2 Status

In terms of housekeeping, tasks such as ground maintenance, removal of tripping hazards, checking of oil/hydrocarbon storage areas, and fire-watch during cutting operations of sensitive areas are covered under daily/weekly/monthly inspection programs conducted by the Health, Safety & Environment (HSE) sub-committee and ISO sub-committee. The frequency of these inspections is a function of the occurrence of such events and the severity of the impact that it may have on the environment.

The International Marine Group has developed an extensive document control system for documents relating to their Environmental Management System (ISO 14001) as well as for non-ISO documents. The ISO related documents are classified into five categories: (1) Audits & Compliance, (2) Sampling & Analysis, (3) Employees, (4) Maintenance and (5) Meeting Minutes. Each of these five categories consists of three sections, namely, Documents (external and internal), Forms and Records. In the case of the first category (Audits & Compliance) a Legislation section is also added were all the applicable legal requirements are stored. With the exception of Records, which are usually hand written, all other documents are filed on computer as well as in filing cabinets. The locations of all documents that are filed are indicated in the electronic versions as well. In addition to standard filing practices that are followed, all folders are colour-labelled for ease of location and to prevent misfiling. As a part of the Document-Record Control System, any change or amendment to documents or forms are done through "New Document/ Form-Change Request Form" and "Document-Record Control Form.

5.7.3 Barriers

There are no significant barriers to implementing good housekeeping and record-keeping practices. It is a challenge for any operation to ensure that throughout all the various time constraints of regular business demands that appropriate house keeping is maintained and records and documents are appropriately managed.

5.8 The Facility Shall Have an Appropriate and Verified Emergency Plan

5.8.1 Applicability

This core element applies to all sites that are involved with the management of industrial liquids or hazardous waste and it is mandatory to have an emergency plan appropriate to the specific nature of hazard and scale of the operations.

5.8.2 Status

As a part of their EMS, the International Marine Group maintains procedures to identify the potentials for and responds to accidents and emergency situations, and for preventing and mitigating the environmental impacts that may be associated with such events.

For establishing such procedures, the Environmental Management Representatives (EMR) reviewed the list of environmental aspects and current operations to identify the potential emergency situations at all three entities. The identified emergency situations pertaining to the ship dismantling operations are, fire, gas or propane leak/explosion, human injury, natural disasters, power failure and spills. In accordance with IMG's provisional Certificate of Approval A120316, IMG submits all emergency response plans to the Port Colborne Fire Department, the Regional Municipality of Niagara and the district office of the Ministry of Environment. IMG has Emergency Response Representatives that meet annually to review emergency response procedures and schedule practice drills. In case modifications are made to the existing procedures, the EMR schedules a training session for all staff to inform them of such changes. In addition, the EMR conducts monthly facility inspections with the site supervisor in accordance with the Joint Health & Safety Committee Operating Criteria to identify new or changed potential emergency situations. As warranted by these inspections, the EMR amends preventive and response procedures and then conducts re-testing of emergency response procedures. The detailed Emergency Response Guide (ERG), including a detailed drawing, indicating the locations of fire extinguishers and spill response containers are provided on site.

5.8.3 Barriers

No barriers exist to limit the ability to create an emergency plan. Depending on the level of effort put into developing the plan, better identification of potential emergency scenarios may be achieved. Generally more thorough planning will lead to a more successful emergency plan.

5.9 The Facility Shall Have an Appropriate and Operative Training Program for the Personnel

5.9.1 Applicability

Training and awareness for the personnel is key to appropriate environmental management and is applicable at all operations.

5.9.2 Status

The Environmental Management Representative (EMR) ensures that all employees, through orientation and training, are aware of and committed to the environmental management system. Through on-going orientation/refresher training program, conducted by the EMR, all new, existing, relocated, or reinstated employees, contractors and other interested parties are made aware of their roles and responsibilities that are required to achieve conformance with company's Environmental Policy, its procedures and other requirements of the EMS, including the Emergency Response Guide. It is ensured that all employees comprehend the environmental benefits associated with EMS through an understanding of the potential impacts that could result in the absence of work instructions and management programs. After each training session, employees are tested on their learning, followed by signing an Acknowledgement of Receipt of training. The EMR is also responsible for training employees on the work instruction and /or environmental management programs developed for jobs that are associated with significant environmental aspects. Those employees are trained on job-specific procedures and consequences of non-conformance. If an external party provides training to employees, the EMR ensures that the training agency is accredited by requesting and obtaining certification(s). Upon completion of training, it is required from the training agency to issue a Certificate of Completion for attending employees. All the training sessions are documented and records are filed for future reference. The facility has set a target of a minimum of 15 hours of training per employee per year.

Fire Safety and Spill Response prevention and training with the Port Colborne Fire Department and/or through IMG's Health – Safety & Environment Department, is scheduled annually on site with all IMG employees. Upon completion all employees are tested on their learning and content of the training sessions are documented and filed.

Red "Significant Environmental Impacts" and a green "Environmental Policy" notices are distributed to all employees along with their weekly salary payments to identify changes on actual or potential significant impacts associated with their work and remind them of company's environmental objectives.

As a part of the EMS, the roles, responsibilities and authorities of various key personnel who manage the overall EMS are defined and documented. Each position within the company has an applicable job description that indicates roles, responsibilities and authority of employees. This is illustrated in the organisational chain of command for IMG.

5.9.3 Barriers

Training of personnel involves a significant internal cost related to labour time, lost of productivity and external cost associated with the delivery of training packages. Cost of training varies greatly depending on the operation and may be a significant barrier to some SMEs.

5.10 The Facility Shall Have an Adequate Financial Guarantee for Emergency Situations and Closure

5.10.1 Applicability

Generally all hazardous waste management facilities in the Province of Ontario, Canada are required to establish a security bond and hold environmental liability insurance. This requirement is generally specified in the facility's authorisation to operate, issued by the provincial government. Security bonds and environmental liability insurance are applicable for operations that have the potential to create significant negative environmental impact if the facility or operation should experience financial difficulties or go uncared for.

5.10.2 Status

The International Marine Group holds five million dollars in coverage for environmental impairment liability for Raw Materials Corporation, which covers site closure, remediation measures in case of major pollution releases or accident caused by wastes and materials and other emergency situations.

The company Director has also posted a bond/ letter of credit for $ 40,000 CDN ($25,000 US) for immediate cleanup costs.

5.10.3 Barriers

A cost is associated with environmental liability insurance and several SME's generally consider it onerous to provide site-specific environmental impairment liability, as these are expensive instruments. The security bond may also be a substantial barrier to some SMEs. Bonds can range from tens of thousands of dollars to millions of dollars, depending on the site operations and the regulator's perceived level of risk/liability related to the operation.

5.11 The Facility Should Have a System in Place for the Exchange of Information on Quality requirements with Waste Producers.

5.11.1 Applicability

This ship dismantling industry's has only limited influence on the way the waste producer provide their waste. MRC often times delivers the ship in tow from the sellers to it's facility for dismantling. MRC will often selectively bid on those ships they wish to accept thus limiting the selection of ship to those with the greatest raw material available for resale. Contamination or 'stow away' materials aboard ships may occurred, however due to MRC's experience in this sector and due to the close proximately of the market, many such incidents can be minimised if not avoided.

5.11.2 Status

Materials recovered from the dismantling of ships are segregated by material type and grade on site and sold to appropriate buyers based on market demands.

5.11.3 Barriers

Overall, the are no systems in place for the exchange of information on quality requirements with waste producers as there is very little 'pre-treatment' or 'post treatment' in the ship dismantling sectors.

6. FACTORS INFLUENCING SUCCESS AND FAILURE

Various mechanisms exist that influence the ability for SMEs to implement EMSs. One primary positive influence is the mandatory regulatory framework and enforcement that exists in both Provincially and Federally. This sets the basic framework for a recycling industry to exist that now supports MRC in collecting and recycling the materials from ships. The waste minimisation concept thrives within the regulatory framework that reinforces this ESM core element with regulatory enforcement.

Training and education of management and employees is key to allow for informed decisions to be made in the creation of corporate policies, environmental procedures, responsibilities and process procedures. Awareness of potential environmental impacts, regulatory requirements and management principles such as ESM is essential to each individual to be able to contribute to the continual improvement of the operation's performance. Regular training and information sessions greatly improve the organization's ability to perform.

Self-checking through monitoring, internal audits and management review allow the organisation to verify if the performance that was planned is being achieved. Mechanisms that enable the organisation to check its own performance and make adjustments and improvements are essential to allow the organisation to first recognise if problems exist and then take action to correct the problem.

Environmental Management Systems are designed on a similar theme as the concepts and mechanisms discussed above. With the implementation of an EMS the core elements of ESM are more easily achieved. The International Marine Group has presented leadership in their sector of Canadian industry for implementing an Environmental Management System – ISO 14001. The company has maintained a continuous improvement program with respect to environmental performance of their operations. They proactively identify potential shortcomings in their operations and take corrective actions to improve operations.

The successful implementation of an EMS Program is dependant on the commitment of the top management and its keen interest in implementation of the environmental systems pertaining to their operations. The management of IMG believes that through implementation of EMS, not only the impacts on the environment are identified and minimised, but also there are economical incentives and benefits associated with it.

It is interesting to note that EMS ISO-14001 implementation incorporates similar core elements of ESM. Since most of the practices pertaining to EMS have been ongoing for over a year at MRC, best current practicable options are explored and if found to be feasible, have been or are in the process of being implemented. Therefore, a majority of the assessment of ESM core performance elements were achieved with the implementation of EMS.

Through implementation of ISO 14001, the awareness of the employees with respect to environmental, health and safety aspects of their duties has increased and they have voluntarily adopted measures to meet the company's environmental objectives. MRC company managers feels that employee awareness over time will result in overall improvement of operations and practices and thus becomes a preventive tool against incidents that may cause downtime and/or costly environmental liabilities. The

implementation of ISO 14001 is further working as a marketing tool, especially among the shipping companies located within the Great Lakes region.

Recognising all the benefits noted above, the core element that is most difficult to implement is establishing a certified EMS. This requirement has a broad impact on all personnel and operations at the organisation. Substantial time, planning and training is required to successfully implement the EMS and have it sustainable to achieve certification. The cost has been shown to include internal and external components that are substantial and often prohibitive to SMEs. It is estimated that establishing and maintaining a certified EMS for an SME may range from $75,000 to $150,000 CDN ($47,000 to $94,000 US) over a three-year period when considering internal and external costs.

To overcome this difficulty, a facility may need to incorporate ESM practices into normal operations such that internal costs are reduced and the philosophies of sound management are inherent in the operations of the organisation.

7. ASSESSMENT OF CORE PERFORMANCE ELEMENTS

MRC has the motivation necessary to undertake initiatives such as ISO 14001. This attitude is essential to create the atmosphere in an organisation for all employees to accept the direction of the company and the decisions it makes. Cost however, remains the major challenge for implementing these and other initiatives.

There may be some concern to the lack of recognition with respect to EMS certification within the ship dismantling industry. Some companies have focused resources to improved their own environmental performance while having to compete with others that may have chosen lower cost business practices that may not protect the environment to the same extent.

Waste minimisation is benefited or limited by the supporting organisations that exist in the economy that are able to assist with the materials or wastes that are generated by MRC. None of the materials removed from the ships are actually recycled or disposed of on-site at MRC. All materials go to other organisations that can reuse or recycle the materials. Where organisations are not available to receive and process a certain type of material, disposal is required. To enhance waste minimisation, operations such as these need to be located to allow for economic transport of materials to recycling facilities.

Education and training are essential to the ability to implement several of the core elements. An organisation must be aware of the regulatory framework in which it operates, recognise when authorisation is required, understand what waste minimisation options exist and understand how an EMS should be developed and maintained including monitoring programs.

8. CONCLUSIONS AND RECOMMENDATIONS

Through the completion of a case study on the applicability of ESM to a SME, several key factors have been identified which will influence implementation of ESM to recycling facilities. Specific evidence was collected through evaluation of MRC, a ship dismantling enterprise.

Below, the key factors associated with ESM implementation are summarised. Recommendations are provided that offer opportunities to enhance the ability and motivation of an SME to subscribe to ESM. Further details of these points are provided in the text of the report.

Education and training is essential to ensure an organisation is able to recognize their requirements and has the understanding and ability to undertake the activities necessary to meet the expectations imposed by the requirements. Training opportunities and sources of information should be made conveniently available to SMEs so that the training and education may occur.

A developed regulatory structure sets the culture under which organisations must operate. Having concepts such as waste minimisation included in the regulations provides much greater motivation to undertake ESM principles. Regulations should be encouraged that stimulate improved performance such as waste minimisation and continual improvement.

Cost appears to be the principle deterrent for organisations to implement all the core elements of ESM. Opportunities should be explored on how to develop and implement ESM so that it may be more easily financial palatable to SMEs. The benefits of implementing ESM should also be promoted along with development of mechanisms that encourage and recognised the importance of EMS within an economic environment.