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# Moving from responsible care codes to RC 14001 management systems: an analysis of effects on activities that impact regulatory compliance and EHS performance

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# Moving From Responsible Care Codes To RC 14001 Management Systems: An Analysis Of Effects On Activities That Impact Regulatory Compliance And EHS Performance

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## ABSTRACT

This study aims to identify how the implementation of an Environmental Management System (EMS), designed to meet the requirements of the Responsible Care 14001:2002 Technical Specification, impacts the activities associated with compliance and improved environmental, health and safety performance.

The results of this research indicated that the implementation of a comprehensive environmental, health and safety management system designed to meet the requirements of RC-14001 impacted positively employee involvement and overall management systems. The degree of impact of the implementation of RC-14001 for each facility was dependent on several factors. The most significant factors were the maturity of their Responsible Care Program, and their level of integration of Responsible Care into existing quality management systems prior to the implementation of RC-14001. All of the facilities indicated that the assessment of aspects and impacts played a significant role in improving their existing processes; including employee participation and goal setting.

This study has significant implication for facilities considering the implementation of RC-14001. This study highlights the benefits of this implementation and some key strategies such as integration of environmental, health and safety management into existing business systems and processes. Facilities with mature systems should concentrate their efforts on the aspects and impacts determination and evaluation; this process has the greatest potential for having an impact on a mature system. For facilities with no existing business management systems, or just implementing Responsible Care, the RC-14001 technical specification may provide an effective roadmap for developing an Environmental Management System.

# 1.0. Introduction

## *1.1 Statement of Problem*

This study aims to identify how the implementation of an Environmental Management System (EMS), designed to meet the requirements of the Responsible Care 14001:2002 Technical Specification, impacts the activities associated with compliance and improved environmental, health and safety performance.

The American Chemistry Council, formerly known as the Chemicals Manufacturers Association, and the EPA conducted a survey of fifty (50) American Chemistry Council (ACC) member companies during 1996-1998. All of these companies had some type of environmental enforcement action taken against them from the period of 1990-1995. The goal of their survey was to identify the root causes of non-compliance. The survey results identified four main actions that the industry could take to improve performance:

- increase employee involvement,
- improve facility Environmental Management System (EMS),
- define management commitment, and
- improve understanding of environmental regulations (Solomon and Mihelcic 223).

The RC-14001:2002 Technical specification is a management system standard that addresses all four main actions listed above (ACC, RC 14001). This study will aim to answer the question how the implementation of RC-14001 addressed these four actions and how effective is in improving performance of these activities at RC-14001 certified facilities.

### *1.2 Significance of Problem*

During the 1980s and 1990s there was an emergence of voluntary codes that addressed environmental management practices. Responsible Care® and the international standard ISO 14001 were two of these voluntary initiatives. Other voluntary codes that were developed during this period included the Coalition for Environmentally Responsible Economies' (CERES) Principles, and the International Chamber of Commerce's (ICC) Charter for Sustainable Development (Nash and Ehrenfeld, "Code Green" 16-31). All of these voluntary codes and initiatives were developed to accomplish specific objectives. In the case of Responsible Care®, the objective was for chemical companies to earn public trust while implementing management practices that prevent chemical releases, and protect the environment, the community, product users and the employees. (ACC, *A History of Accomplishments*).

ACC's Responsible Care® Initiative, which now is over 15 years old, has been revised, and has incorporated into its design the Deming's principles (PLAN-DO-CHECK-ACT). The American Chemistry Council now requires its members to obtain a third-party verification and certification in one of two management system technical specifications: RC 14001 and Responsible Care Management System (RCMS).

This research aims to identify how this redesign of Responsible Care® has translated in significant changes or improvements at the facility level. The significance of this study is that it evaluates the effectiveness of implementing a management system, designed to meet RC 14001 requirements, in improving activities or areas that are recognized as to leading to improved compliance and EHS performance. The areas that this study focused on are employee

involvement, overall management systems, management commitment, and understanding of applicable regulations.

RC 14001 is the fusion of an international environmental standard and an industry-created voluntary code, Responsible Care® (ACC, RC14001.) This model could be incorporated in other countries as well as in other industries and organizations.

Over the past decade, there has been a widespread acceptance within government entities, industry and other global stakeholders of the idea that the implementation of an Environmental Management System (EMS) may be an effective non-regulatory policy tool that promotes continuous environmental performance; minimization of environmental, health and safety impacts; and pollution prevention. These voluntary codes go beyond the typical scopes of the regulatory strategies and shift the responsibility to the private sector. (Nash and Ehrenfeld, "Code Green" 16-31).

The effort of the American Chemistry Council to embrace ISO 14001 and merge with its Responsible Care® Codes, thus creating RC-14001, is of great significance to the Chemical Industry as well to other industries. The lessons learned from this redesign of this voluntary industry codes could be used in other industries as model of embracing EMS, ISO 14001, and continuous environmental performance improvement goals.

In his study, Barmasse asked the question: "Is it feasible to implement ISO 14001 in addition to existing commitment to implement Responsible Care® in a small US chemical facility?" (Barmasse). He concluded that the small US chemical companies have adopted the 'wait and see' attitude due to tight resources. These companies were waiting for a compelling reason to adopt ISO 14001 (Abstract).

Facilities that implement a management system to the specifications of RC 14001, may obtain dual certification in RC 14001 and ISO 14001. Along with peer-driven requirements, the global market has driven many facilities to adopt ISO 14001 to satisfy their customers' requirements. The compelling reasons that the chemical companies were waiting for to adopt a formal management system may be knocking at their doors.

This study will look at chemical facilities that have implemented an Environmental Management System that meets the requirements of RC14001 and have obtained certification. The goal of this research is to identify the effects of RC-14001 implementation on activities that impact compliance and EHS performance. The results of this study may be used in assessing the level of effectiveness of self-regulation driven by a trade association.

## *1.3 Limitations/Delimitations*

### 1.3.1 Limitations

The goal of this work is to identify how the implementation of a management system, designed to meet the requirements of RC-14001 Technical Specification, impacts the performance of activities that contribute to meeting regulatory requirements and improving environmental, health and safety performance.

The researcher has conducted a literature review on the subject. When references to RC-14001 are not available, the researcher utilized references to ISO-14001, since RC-14001 encompasses the requirement of this standard. For this study, the researcher used online databases, the resources of the RIT Wallace Memorial Library, Internet search engines, and other resources available from the American Chemistry Council. The researcher was limited to those materials available to the general public from the American Chemistry Council's websites. The researcher utilized her contacts at the ACC to obtain additional information as needed.

For the purpose of this study, the researcher interviewed facilities that have obtained RC-14001 certification. There are a limited number of facilities that have obtained this certification; therefore, the researcher was limited in the size of the sample collected.

The researcher was also limited by the willingness and openness of the interviewees. Some interviewees are limited by their company's policies on confidentiality. The researcher will honor requests for confidentiality.

1.3.2. Delimitations

This study aims to identify the impact of implementing an Environmental Management System (EMS) that meet RC-14001 requirements on activities that contribute to improve EHS performance and compliance specifically focusing on employee involvement, improvement on overall EMS, management commitment, and understanding of applicable regulations.

The researcher will include background information and current issues that may cover other areas, but the researcher will maintain the focus of interviews on those four areas.

### *1.4 Description of Terms*

**ACC** – American Chemistry Council, formerly known as the Chemical Manufacturers Association (CMA). This organization represents companies involved in the chemical industry.

**EMS**- Environmental Management System. For the purpose of this study, the term "EMS" will also be used to refer to a management system that includes environmental, health and safety elements.

**ISO 14001**- An Environmental Management System (EMS) international standard formulated by the International Organization for Standardization (ISO) in 1996. (Nash and Ehrenfeld, *"Code Green"* 6).

**ISO**- International Organization for Standardization. This organization was formed in 1946 and in headquartered in Geneva, Switzerland. This organization facilitates standardization which aids in international trade (Nash and Ehrenfeld, *Code Green* 6)

**RC 14001**- Responsible Care® 14001 Management System Technical Specification adopted by the American Chemistry Council in 2002 (ACC, *RC-14001*).

**RCMS**- Management system that incorporates environmental, health, safety and Responsible Care elements.

**Responsible Care®-** It is a voluntary initiative adopted by the American Chemistry Council in the United States. Since its inception in 1988, this initiative has been adopted by the chemical industry in other 40 countries. Responsible Care® is a registered trademark of the American Chemistry Council (ACC, RC-14001). In this paper, the term Responsible Care® will be used to refer to the U.S. initiative.

**SOCMA-** Synthetic Organic Chemical Manufacturers Association.

## 2.0 Background

This chapter provides background information about Responsible Care®. It outlines Responsible Care's history in the United States as well as its limitations. The last sections of this chapter discuss the changes made to Responsible Care in 2002 and introduce the framework of RC-14001.

### *2.1 History of Responsible Care® in the United States*

At the time that Responsible Care® was developed and then adopted the chemical industry was under strong scrutiny. There were several incidents involving chemical facilities that had caught the public's interest. One of these incidents was Union Carbide's devastating accident in Bhopal, India in 1984. The chemical industry feared that if the industry itself did not respond to the public concerns, it would become more heavily regulated (Nash and Ehrenfeld, *"Code Green"* 16-31).

Four months after the Bhopal incident, the American Chemistry Council introduced the Community Awareness and Emergency Response (CAER) program. This program required member companies to revisit their emergency plans and required them to include the community's recovery needs in these plans (American Chemistry Council, *A History of Accomplishments* 2). In 1988 the ACC adopted the Canadian Chemicals Producers Association's (CCPA) Responsible Care® guiding principles (American Chemistry Council, *A History of Accomplishments* 1). The CCPA adopted the Guiding Principles in 1978 (CCPA). The CCPA Guiding Principles and the original CAER program were the foundations for the Responsible Care initiative adopted by the American Chemistry Council. The Synthetic Organic chemical Manufacturers Association (SOCMA) adopted Responsible Care® two years later (Canning, 4).

Appendix A includes the complete list of the Responsible Care® Guiding Principles as adopted by the ACC.

After the adoption of the Guiding Principles, a series of codes of management practices were developed. These codes were guidelines that addressed environmental, health and safety concerns. Each of these codes has a three-part structure: Purpose, Relationship to the Guiding Principles, and a description of the Management Practices. The six codes of management practices are listed below:

- *Community Awareness and Emergency Response (CAER)*

The goal of this code is to ensure emergency preparedness, and to promote the community right-to know. This code aims to promote emergency planning, and involvement with the local communities (ACC, *Responsible Care-Codes of Management Practices* 1).

- *Pollution Prevention*

This code aims to achieve reduction of releases to air, water and land. It also addresses the management and reduction of waste (ACC, *Responsible Care-Codes of Management Practices* 9).

- *Process Safety*

The objective of this code is to prevent fires, explosions and accidental chemical releases. It is based in the principle that facilities are safer if they are designed, built, operated and maintained according to sound engineering practices (ACC, *Responsible Care-Codes of Management Practices* 12).

- *Distribution*

This code aims to reduce employee and public risks in transportation, storage and handling of chemicals (ACC, *Responsible Care-Codes of Management Practices* 4).

- *Employee Health and Safety*

This code aims to protect chemical facilities' employees. The Management Practices in this code give guidelines in four basic areas of a health and safety program: Program Management; Identification and Evaluation; Prevention and Control; and Communication and Training (ACC, *Responsible Care-Codes of Management Practices* 7).

- *Product Stewardship*

This code aims to address product safety through the life cycle of the product including usage of the product. This code requires companies to establish a system to evaluate and characterize product risk. It also requires members to educate employees, customers, suppliers, and contract manufacturers about the environmental, health and safety (EHS) risks associated with their products (ACC, *Responsible Care-Codes of Management Practices* 15-16).

In 1993, two additional elements were added to Responsible Care®: Mutual Assistance and the Partnership programs. The Mutual Assistance program encouraged companies to help each other, and encouraged them to share practices that will help them meet the Responsible Care's commitments. The Partnership program allowed companies that otherwise will not qualify for ACC membership to be part of the Responsible Care initiatives. Examples of these types of companies are carriers, and storage facilities. (ACC, *Overview*).

In 1996, the Management System Verification process was adopted by the American Chemistry Council. The goal of this process was to assess members Responsible Care implementation status. During this process, a member company's systems were reviewed by a peer company and community representatives against the Codes of Management Practices. A

third-party, a consultant, facilitated the process. At the end of the assessments, the assessment team identified "Opportunities for Improvement." During that time, the team will also assess if the company had best practices that could be shared with others, and those were classified as "Examples of Excellence" (American Chemistry Council, *A History of Accomplishments* 2).

The American Chemistry Council expectations about Responsible Care® from each of its member companies is that they will sign to, and adhere to the Guiding Principles, communicate their commitment, and 'make good faith efforts' towards meeting the Codes. *(Nash* and Ehrenfeld, *"Code Green"* 16-31).

Responsible Care® required companies to report their progress on implementing specific practices associated with each code of management practices. ACC members were required to conduct a self-evaluation annually against each code and report the progress status to the ACC. This information was not publicly available but instead the ACC members were encouraged to discuss the findings with their key stakeholders (Nash and Ehrenfeld, "Code Green" 16-31). This self-evaluation process was stopped in 2002 when the new changes to Responsible Care were introduced. Those changes and the reasons for them are discussed in the following sections.

### *2.2 New Responsible Care®*

The most significant changes that Responsible Care underwent in 2002 were in 4 major areas: codes of management practices, third-party verification, performance data and security requirements (Canning 4). A summary of these changes are highlighted below:

- *Codes of Management Practices*

  SOCMA and ACC members are no longer required to implement the six original Codes (Employee Health and Safety, Process Safety, Pollution Prevention, Distribution, CAER, Product Stewardship). Instead they are required to implement a management system, a Responsible Care Management System (RCMS) that meets either the RCMS or RC 14001 Technical Specifications. Both technical specifications incorporated Deming's Plan-Do-Check-Act Cycle Refer to See Figure 1. Plan-Do-Check-Cycle-A Continuous Process . A more detailed framework is provided in Figure 2. RC 14001, the focus of this study, incorporated ISO 14001. A facility designing their environmental management system to meet the RC-14001 technical specification may obtain both ISO 14001 and RC-14001 certifications.

  The ACC suggests that companies review the Codes of Management Practices and consider them for implementation to aid in the design of the RCMS. (ACC, *Responsible Care Codes of Management Practices*). The Codes are now examples of the types of activities that will fall under the management system. The Codes principles are now incorporated into the RCMS and RC14001 specification (Canning 4).

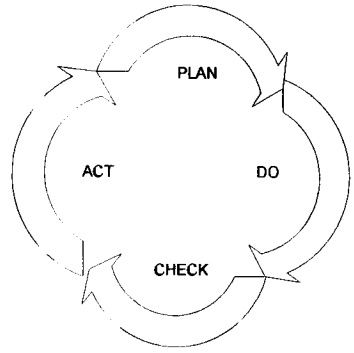


**Figure 1. Plan-Do-Check-Cycle-A Continuous Process .**

**Policy & Leadership**
Leadership & Responsibility
Commitment

**Planning**
- Define Risks/Hazards
- Process/Program Development
Objectives & Targets
Communication

**Implementation, Operation & Accountability**
Training
- Procedures
Management of Change
Documentation
Employee Empowerment

**Performance Measurement & Corrective Action**
- Self-Assessment
Internal Audits
- Corrective/Preventative Action
Incident Investigations
Records Management
Measurements

**Management System Review**
-Management System Review

**Figure 2. Framework for Responsible Care Management System (Yosie 2)**

The change from Responsible Care® Codes to management system is driven by the goals of establishing a more efficient system that is documented for planning, reviewing and improving performance (Schmitt, *Building*).

- *Third Party Verification*

The ACC and SOCMA require its members to obtain RCMS or RC14001 certification by a third-party verifier (Canning 4, "SOCMA"). Table 1 shows the ACC members certification timing and deadlines requirements based on the number of sites that the ACC member has in the United States.

The verifier will either pass the location or identify non-conformances. Once the requirements have been met by the member company, the Registrar will award certificates for ISO 14001 and RC14001.

**Table 1. ACC Member Certification Timing (Yosie, 3)**

| COMPANY SIZE (BASED ON U.S. SITES) | REQUIREMENT | 12/2005 | 12/2007 | 1/2008-12/2010 |
|---|---|---|---|---|
| 1-25 Sites | 33% of site (to a max of 4) | Headquarters (HQ) audited | Site Requirements Met | Next Cycle |
| 25-40 Sites | 6 sites | HQ Audited | Site Requirements met | Next Cycle |
| 40+ sites | 8 sites | HQ Audited | Site Requirements Met | Next Cycle |

- *Performance Data.*

In the past, the ACC published key performance data as aggregated data for the members. These data included pounds of chemical releases as defined by

EPA's Toxic Release Inventory (TRI), number of process safety incidents, and the OSHA recordable rates, among others (Canning 4). Now each company members is required to submit data for the following performance metrics:

a. Pounds of TRI releases
b. Number of reportable distribution incidents
c. Number of process safety incidents
d. OSHA recordable Occupational Injury and Illness Incident rate for employees and contractors
e. Percent of facilities completing security assessment
f. Percent of facilities completing security enhancements
g. Certification of RCMS or RC14001
h. Greenhouse emissions
i. Energy efficiency
j. Industry economic performance in four key areas:
    1. Total industry R&D investment
    2. Total number of industry employees
    3. Total value of industry payroll
    4. Total value of U.S. industry net exports
k. Documented process to characterize and manage product risks

More detailed information about the metrics and how they will be reported are available in Appendix B: Responsible Care Performance Measures. American Chemistry Council hopes that these measures will enable its members identify areas for improvement. These measures eventually will be available in the

American Chemistry Council enabling the public to track and measure progress of the member companies. These measures selected by ACC members not only track Environmental, Health & Safety aspects but also focuses on economics, security and products (ACC, *Performance Measures*).

- *Security Requirements*

  Among the changes to Responsible Care, there is the addition of a Security Code of Management Practices. Unlike the other six Codes, the ACC and SOCMA are requiring their members to comply with the requirements of this Code. The aim of this code is to safeguard facilities and the communities surrounding it from terrorist attacks or threats. This Code has thirteen (13) management practices which facilities are required to comply by specific deadlines. The Code requires companies to classify their site into four tiers; Tier 1 poses the greatest risk for potential offsite consequences and Tier 4 has no potential for offsite-consequences in the event of an attack. Facilities are required to conduct site vulnerability assessments and implement measures that are appropriate with the level of risk. As indicated above, the completion of the assessments and the completion of security enhancements are part of the new performance measures.

The new Responsible Care is aimed to improve EHS performance, and gain credibility and transparency. In this study, the aim is to investigate the impact of implementing a management system that complies with the new RC-14001 technical specification while studying its impact on four activities associated with improved performance. Those areas are: employee involvement, improvement of management

systems, management commitment and understanding of applicable regulations. In the following section, RC-14001 requirements are presented and discussed.

## *2.3 RC-14001 Anatomy*

### 2.3.1 Management System Definitions

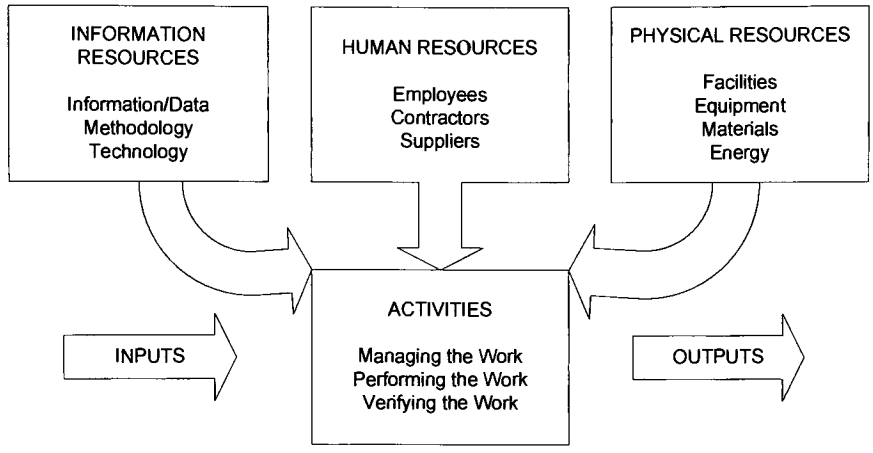


**Figure 3 Process Diagram (Modified from Jones, Exhibit 1)**

The ISO 14001 guidance document defines an Environmental Management System (EMS) as the overall management system that includes the following elements: organizational structure, planning, assignment of responsibilities, procedures, practices, processes and resources (ANSI/ISO). All of these elements are aimed to developing, maintaining and achieving the environmental policy (ANSI/ISO).

An expanded definition of an EMS will include elements such as, information management tools, performance measurements, and periodic review processes (Nestel 63). According to ISO 9000 standards, a system is of set interfacing elements or processes (Jones 3). A process, illustrated in Figure 3, is the set of interacting activities which converts or transforms inputs into outputs (Jones 3). A management system is set of interfacing processes use to establish policy and objectives, and use to achieve those objectives (Jones 3).

For the purpose of this study, an EMS or Responsible Care Management System (RCMS) is the set of interrelated processes, use to establish environmental, health and safety policy and objectives, including the processes use to achieve those objectives.

2.3.2 Comparison between ISO 14001 and RC 14001

RC 14001 incorporated the ISO 14001 standard 'word by word'; a facility that meets the requirements of RC-14001 also meets the requirements of ISO 14001. RC 14001 has the same elements, sections and subparagraph naming as ISO 14001. RC 14001 added additional requirements to the language of ISO 14001. That additional language and requirements are discussed in the following sections.

*Section 4.1 General Requirements*

In this section, the RC 14001 technical specification requires that the organization establish and maintain a management system that includes Responsible Care®, health, safety and environment (ACC, *RC-14001*).

*Section 4.2 Environmental Policy*

In this section the RC 14001 technical specification add three specific elements to the ISO 14001 requirements. These requirements are:

a) Demonstration of personal commitment by senior management to Responsible Care®.

b) Fostering of openness with stakeholders, considering the public and employee input.

c) The commitment to the Guiding Principles of Responsible Care must be 'reflected' (ACC, *RC 14001* 1).

*Section 4.3.1 Environmental Aspects*

In this section, the RC 14001 technical specification lists specific elements or areas that the organization shall focus on, including transportation risk assessments and product risk information management systems (ACC, *RC-14001*).

*Section 4.3.4 Environmental Management programmme(s)*

In this section, RC 14001 requires companies to include systems to assess risk for new, and existing products and processes (ACC, *RC-14001*).

*Section 4.4.1 Structure and Responsibility.*

In this section RC 14001 requires systems to identify EHS resource needs and the establishment and maintenance of a performance management system that recognizes excellence in Responsible Care®, and EHS (ACC, *RC-14001*).

*Section 4.4.3 Communication*

In this section RC14001 added four major bullets and requires that the organization implementing RC 14001 complies with the following:

a) Establish a process that addresses the concerns of 'interested parties'.

b) Establish communication and implementation programs that involve the organization employees.

c) Establish dialogue with stakeholders about relevant risks; the organization's impact on human health, and the environment; its EHS performance, and its future plans.

d) Participate in mutual assistance programs and sharing activities.

ACC, *RC 14001* 5).

*Section 4.4.6 Operational Controls*

RC 14001 outlines very specific requirements in addition to the ones outlined in the ISO 14001 language. There are five specific requirements listed in this section. It requires the organization to establish and maintain:

a) Operational and maintenance procedures that ensure safe operations and Responsible Care's objectives and goals are met.

b) Specific procedures and programs to address emissions reductions, pollution prevention and groundwater protection.

c) A system that provide third party providers (contractors, carriers, distributors) information and training requirements on the risk and hazards of the organizations processes and products. Also, it requires that the organization have a system for receiving the same type of information from their supplies.

d) A system that address the EHS performance of third party providers (contractors, carriers, distributors).

e) A system that could ensure that safe handling of the organization's products (ACC, *RC14001* 7).

*Section 4.4.7. Emergency Preparedness and Response*

In this section RC 14001 adds the requirements of including considerations of communication and community recovery needs, and documented process for responding to emergencies related to chemicals transport incidents. It

also requires that the organization participate in community emergency response planning activities (ACC, *RC 14001* 8).

*Section 4.5.2 Nonconformance and corrective and preventive action.*

The RC 14001 adds very specific requirements to this section. It requires that the organization implement a non-conformance system that address the identification of root cause(s), and that lead to the recommendation and implementation of corrective and preventative actions.

RC 14001 also requires that the EHS performance of carriers, suppliers, distributors, customers, contractors and other third party providers are reviewed (ACC, *RC 14001* 9).

*Section 4.5.3 Records*

In this section RC 14001 requires that the organization uses records to analyze and study trends in EHS performance (ACC, *RC 14001* 9).

*Section 4.5.4 Environmental Management System Audit*

In addition to meeting of the ISO 14001 auditing requirements, RC 14001 also requires the organization to evaluate the effectiveness of its communication programs (ACC, *RC 14001* 10).

## *2.4 Summary*

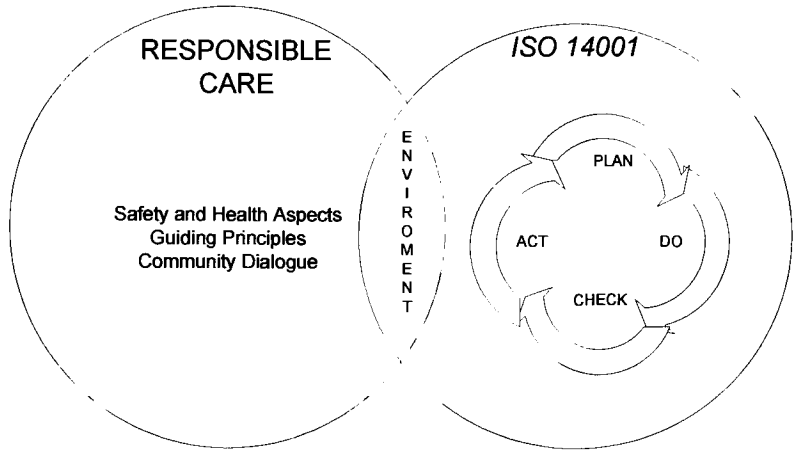


**Figure 4. RC-14001: Responsible Care and ISO 14001 Venn Diagram**

In this chapter, the history of Responsible Care® in the United States was discussed. The 2002 changes to this initiative and voluntary code were discussed. The most significant changes were the transition from Codes to management systems, the requirements for third-party verifiers, and new performance data reporting requirements. All of these changes aimed to increasing the credibility and the transparency of the chemical industry. In addition to these changes, the new Security Code was briefly discussed.

The focus of this research study is RC-14001. This chapter covered the basic requirements of these technical specifications. Figure 4 (above) illustrates the fusion of Responsible Care and ISO 14001. Responsible Care brings to this union, the safety and health aspects, the Guiding Principles and the community dialogue. ISO 14001 brings the framework of the Deming's Principle of Plan-Do-Check-Act continuous cycle.

## 3.0 Literature Review

As discussed in the previous chapter, Responsible Care underwent a strategic review and significant changes in 2002. One of the most significant changes was the introduction of the requirements of certification of its members in one of two environmental management system specifications: RCMS or RC-14001. This study focus on the impact of implementing a management system, designed to meet the requirements of RC-14001, on four activities linked to EHS performance and compliance.

This chapter will review the literature available on Responsible Care, RC-14001 and the EMS implementation in chemical facilities. Since the introduction of RC-14001, there are only a limited number of facilities that have implemented RC-14001 and become certified by third-party. There are no published research studies that relate to RC-14001 at this time. However, there are several studies that have looked at the effectiveness of Responsible Care to improve EHS performance. This chapter will summarize those studies. Also, this chapter will look at studies that have linked the four focus activities areas of this research to EHS performance and compliance.

### *3.1 Background Literature*

In a study conducted in 1995 and published in 2000, the authors studied 16 U.S. Chemical firms that had established Responsible Care program and initiatives. In this study, King and Lenox studied the effectiveness of Responsible Care as a mechanism to self-regulate and as an agent of change of an organization's behavior in terms of environmental performance. In this study the authors seek to study basic theory in terms of self-regulation: These theories are outlined below:

- *Theory A*. Industry self-regulation will fail because it lacks explicit penalties or sanctions.
- *Theory B*: Industry self-regulation can shape control behavior without explicit sanctions by using informal coercion, and normative and mimetic means.

Informal coercion refers to the mechanisms that may include publishing or highlighting poor performance results of lagging companies or having closed meeting with CEOs to hold the company accountable and cause embarrassment. Normative forces refer to the setting of new norms and values that changes an organizations preference for collectively valued actions. A mimetic force refers to transferring best practices or a company mimicking the behavior companies that have systems that work (King and Lenox).

In this study (King and Lenox), looked at how the Responsible Care program could contribute to the adoption of new values and best practices through informal coercion. To test the hypotheses several sets of data were collected and several mathematical models were created. TRI data along with Dun& Bradstreet were used for the period of 1987-1996. That combination allowed the researchers to take in consideration changes in production in the facility when calculating the relative emissions and ratio of improvements (King and Lenox 704-709).

The data showed no evidence that Responsible Care has positively impacted the rate of improvement of its members. In fact, it seems that non-members are improving at a faster rate. The authors however noted that this result is not surprising "that Responsible Care does not significantly influence environmental improvement in the fixed-effect model, since there is little entry and exit into Responsible Care." (King and Lenox 708). Another explanation for the results that the authors gave for the results is that ACC non-members might have received more attention and pressure from external stakeholders to improve their environmental performances.

The authors concluded that ACC members might include a disproportionate number of poor performers. The authors stated that Responsible Care "might have fallen to enough opportunism". Where companies might join to disguise the poor performance, where they adopt the outward or visible form of the standard but evade the real effort required. (King and Lenox 713). The authors hypothesized that explicit sanctions in fact may be needed to avoid opportunism with an industry self-regulatory method. Another method is to ensure that performance data is published to bring into the picture the public scrutiny. (King and Lenox 713).

The authors noted that in practices that were visible to the public or external stakeholders, companies have adopted very similar practices. For example, to comply with Community Awareness and Emergency Response Code's requirements of establishing a community dialogue, many facilities have established a Community Advisory Panel or CAP. However, in practices that are internal to the facility the level of implementation and functions impacted vary greatly. The authors concluded that the results support other studies that suggest that companies may respond strategically to institutional pressures (King and Lenox).

A 1997 study may provide an explanation about the organizational behaviors noted by King and Lenox. Prakash studied two firms and their voluntary commitments, one of them adhered to Responsible Care Guiding Principles and Codes.. Prakash concluded that: "1) Firms are less likely to adopt environmental policies that require significant organization changes; and 2) firms are more likely to adopt policies that are encouraged by external actors with abilities to significantly influence firms' business environments. (Abstract)."

In another 2000 study, Iannuzzi studied self-regulation. He studied four self-regulated programs, 'Responsible Care, Project XL, OSHA Voluntary Protection Program and EPA Star

Track program. He concluded that self-regulation has a promising future in assisting the government focus on resources on poor performers while self-regulated good performers regulate themselves with minimal agency oversight. He found that seven elements were essential for a successful self-regulated program: clear goals, government involvement, significant benefits/incentives, minimal complexity, legal standing, stakeholder involvement and a beyond-compliance component. He identified key program elements to be: annual regulatory compliance audits, third-party verification of compliance and ISO 14001 certification (Iannuzzi).

In April 2004, the U.S. Public Interest Research Group (PIRG) published a report where it highlighted the shortcomings of Responsible Care to deliver and to protect communities from accidental chemical releases or potential terrorist attacks (Purvis and Bauler 1-7). In this report, the authors identified five basic shortcomings associated with Responsible Care:

- Self-Regulated
- Lack of Specific Standards and Deliverables
- Weak Third Party Evaluations
- Lack of Public Accountability
- Failure to Require Inherently Safer Technology

The authors conclude that additional federal regulations are needed to reduce or to eliminate the possibility of accidents or attacks through the use of safer chemicals and processes. (Purvis and Bauler 1). Some of the limitations of this study is the type of data collected and the interpretation data. For example, the data used the Occupational Injury and Illness rate published in the American Chemistry Council website, which includes other types of incidents not related to the use of chemicals.

In April 2004, the Chemical Market Reporter published an article where the findings by the U.S Public Interest Research Group (PIRG) are discussed as well as the ACC position noted. The US PIRG analyzed accident data from 1990 to 2003 for ACC member facilities. The report highlighted that more than 1800 accidents per year could be attributed to ACC members and comparing the data over the years, it concludes that there have no significant accident reduction for ACC members who are required to subscribe to Responsible Care. U.S. PIRG argues that ACC's voluntary code, Responsible Care failed to consider inherently safer technology, which included substituting for safer chemicals and processes. The author noted ACC position in this article. ACC respond to this report is that the actual number of accidents that involved chemicals actually have been reduced since 1995.

Opportunities for Improvement

In 2002 the American Chemistry Council formed a Task Force to re-examine Responsible Care status and to make recommendations for improvement. Among the reasons that the Council decided to re-evaluate the Responsible Care is that the value of this initiative has been questioned by members and the public (ACC, *Overview-Why Change?*). Listed below are the reasons that the Council identified for re-evaluating and improving Responsible Care:

- Since the adoption of Responsible Care, the regulatory environment has changed. About 80% of the practices included in the Codes are now required by regulation (ACC, *Overview-Why Change?*). The bar had been raised; the regulatory environment and the environmental management field had evolved.
- The Management System Verification process did not seem to have caught the interest of its members (ACC, *Overview-Why Change?*).

- The performance of the members had begun to level off (ACC, *Overview-Why Change?*). Refer to Figures 5, 6 and 7. All of these figures seem to indicate that the performance of the members is almost flat for the past recent years.

  Figure 1 shows the pounds releases to total pounds released to the air, water and land by ACC members and it compares it to the chemical industry overall and the total manufacturing industry in the U.S. Although, it shows that ACC members' aggregates are lower for each year shown, it does not show a significant improvement since 1999.

  Figures 6 and 7 show the Occupational Incident Rates as reported to Occupational Administration of Safety and Health (OSHA). Again, the numbers for ACC members as aggregated numbers are lower than the general industry. However, they are almost flat since the late 1990s. Figure 6 shows a slight increase in the incidence rate of occupational injuries and illness from 1999 to 2001 when compared to 1998 numbers.

- Responsible Care lacks external stakeholder recognition and support. In recent years, the Automotive Industry required its Tier One suppliers to become ISO 14001 certified; Responsible Care implementation was not seen as an acceptable alternative to the ISO standard. (Sissell, "ACC Fine-Tunes")

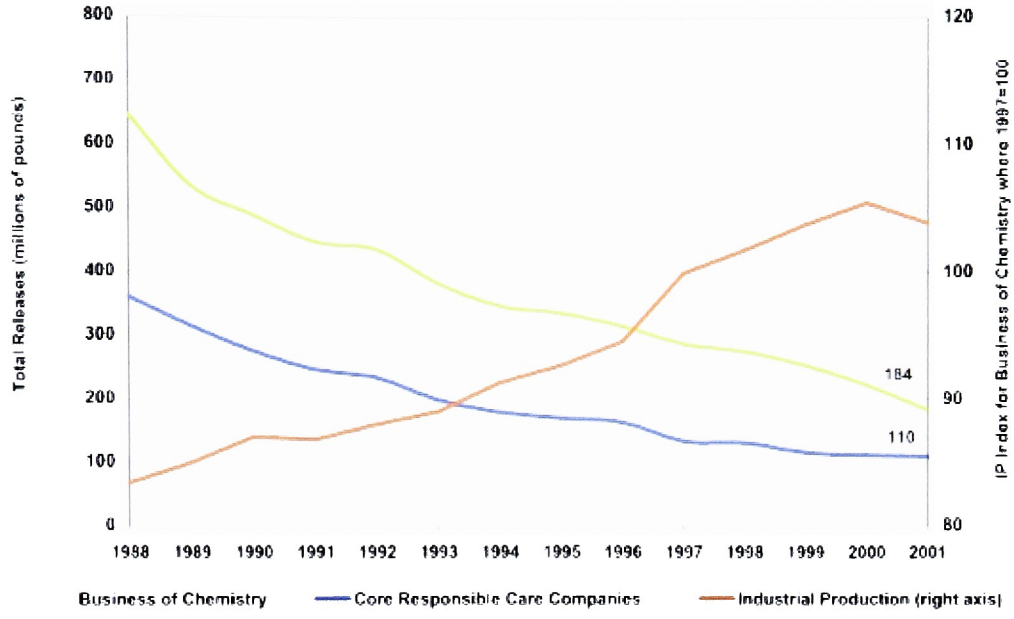


**Figure 5. Total Pounds Releases to Air, Land and Water from 1988 to 2001 (ACC, Environment).**

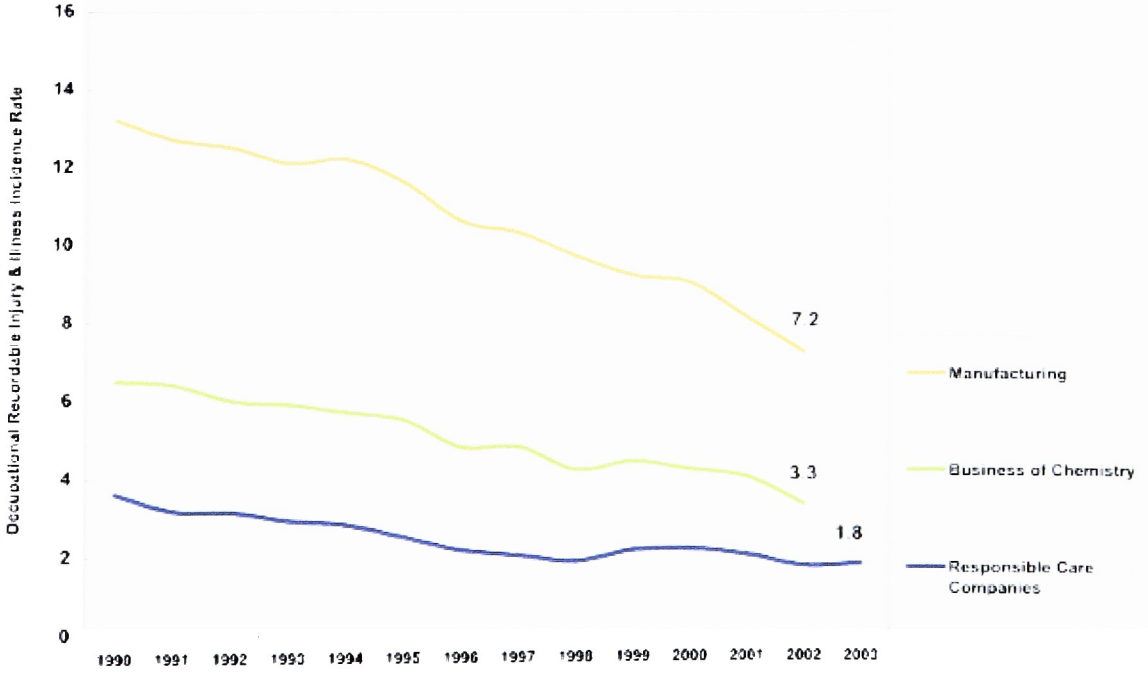


**Figure 6. Occupational Recordable Injury Incident Rates (ACC, *Safety*).**

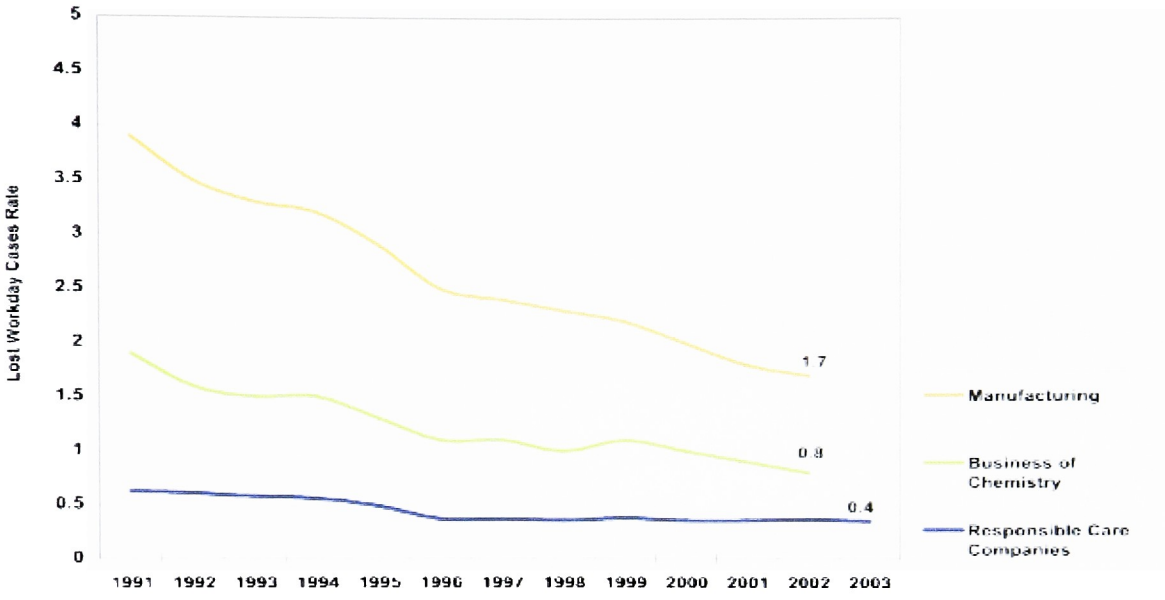


**Figure 7. Lost Work dates Incident Rate for Responsible Care Companies (ACC, *Safety*).**

In the late 1990s and early 2000's, criticism has grown over the transparency of the chemical industry. Public opinion surveys and interviews with stakeholders indicate that the general public does not believe that the chemical industry is committed to transparency or to being open about the industry's performance. (ACC, *Overview-Strategic Review*). The American Chemistry Council has published a limited number of metrics on the past but these metrics have been reported on aggregate basis. The general public seeking to monitor and track the progress of a particular company is limited to information available on government sponsored sites.

From the review of past performance and by the results of a series of interviews with stakeholders, the ACC concluded that external stakeholders saw Responsible Care not as significant driver to performance improvements. The results of interviews indicated that there is a strong support for establishing performance objectives and metrics. That there is further work

to do in terms of credibility for the industry and as well as for transparency (ACC, *Overview- Why Change?*).

In 2002, the Task Force submitted their recommendations for improvement and they were adopted by the Council. These recommendations were aimed to revamping Responsible Care. These recommendations aim to increasing the business value of Responsible Care, enhancing credibility and transparency (ACC, *Overview- Why Change?*).

Management Systems and EHS Performance

The ACC (formerly known as the Chemicals Manufacturers Association (CMA)), and the EPA conducted a survey of 50 ACC member companies from 1996-1998. All of these companies have had some type of enforcement action from the period of 1990-1995. The goal of the survey was to identify the root causes of non-compliance. The survey results identified four main actions that the industry could take to improve performance:

-increase employee involvement,

-improve facility Environmental Management System (EMS),

-define management commitment, and

-improve understanding of environmental regulations (Solomon and Mihelcic 223).

In 2000, Dr. Solomon conducted a parallel survey to the EPA/ACC Survey that focused on the challenges facing small chemical companies in improving their environmental performance. The results of his survey indicated that small chemical companies are less familiar with the applicable environmental legal requirements and less likely to improve their environmental performance than larger chemical companies (Solomon and Mihelcic 223). The survey results identified three main actions that the industry could take improve compliance:

-improve facility Environmental Management System (EMS),

-improve recordkeeping procedures,

-increase awareness of environmental requirements by plant workers (Solomon and Mihelcic 223).

In July 1999, EPA and ACC released the "EPA.CMA Root Cause Analysis Pilot Project Report." The goal of this study and report was to examine the underlying causes or root-causes of environmental non-compliance incidents. The study looked at 47 cases that involved federal civil enforcement action between 1990 and 1995 involving chemical facilities. To conduct this study a survey was conducted. The results of this survey showed that the leading causes for non-compliance were individual responsibility and lack of awareness of regulatory requirements. The report highlighted the importance of environmental management systems (EMS). The results indicated that 41% of the respondents to the survey indicated that that Responsible Care or another type of EMS would have contributed to the prevention of the incidents. The report concluded that both government and industry could help improvement compliance performance. In the case of the government, it could provide technical assistance and compliance assistance tools that better meet the needs of the industry. From the industry side, the reported stated: that more emphasis should be placed by manufacturers on developing and maintaining comprehensive, well-integrated, and clearly articulated EMS (US EPA, *National News*).

Self-Regulation Effectiveness

A 1998 study identified certain conditions that need to be resent in order for self-regulation to work and be effective. Among them were: "high exit costs from industry, a history of effective cooperation; expertise and resources are available; non-compliant behavior can be

punished; consumers value compliant behavior; fair and adequate dispute settlement mechanisms are in place; and some role is available for public participation or oversight." For this study several models of self-regulations were studied, including Responsible Care.

In a study published on 2001 on the book Regulation from the Inside-Can Environmental Management Systems Achieve Policy Goals? , the authors explored the reasons why firms adopt advanced management practices. They conducted a survey of 583 facilities in Pennsylvania (Florida and Davidson 100-101). Among the advance management practices studies, there was EMS, ISO 14001, quality management and pollution prevention (Florida and Davidson 100-101). The authors conclude that companies that adopt EMS are organizations with more advanced practices in places in general. They have quality management programs in place, the use internal audits, and use sophisticated management systems (Florida and Davidson 99-100). These facilities tended to be part of a large corporation suggesting that more resources are available for implementation (Florida and Davidson 99-100). They also tended to have more involvement of their surrounding communities (Florida and Davidson 99-100). The authors conclude that there must a strong relationship between EMS adoption and the generation of positive environmental results. The results of the study are inconclusive in establishing if there is a causal relationship between EMS adoption and the impact to the environmental. There were a significant number of variables that may have impacted the results that were not isolated or studied in detail this research.

Factors influencing EMS Outcomes

Several models or instruments had been created to assess management system (Redinger and Levine). In 1998 an effort was made to create a universal OHSMS performance measurement tool. Four models were used to develop this tool (Redinger and Levine):

- OSHA Voluntary Protection Program
- British Standard Institute OHSMS, BS 8800:1996,
- American Industry Hygiene Association's OHSMS
- ISO 14001:1996.

The researchers identified four key system components that were critical to the success of the system:

- Communication system/feedback channels, system evaluations, including development and measurement of performance measures and root cause analysis
- Continual improvement
- Integration
- Management review.

Although the model development took into consideration several sources and current models, the authors identified an additional need to test the model in the field (Redinger and Levine). The authors since the publication of this paper has written other paper were the tool was tested. Their results validated the tool. (Redinger and Levine).

In their study, "Factors that Shape EMS Outcomes in Firms", the authors evaluated the relationship between having a formal Environmental Management System (EMS) and environmental performance results (Nash and Ehrenfeld 61). In their study, the authors reviewed

two case studies, several trade associations EMSs, and referred to several studies that looked at Responsible Care effectiveness in promoting environmental excellence. They defined environmental excellence as performance that exceeds some normal baseline. The authors concluded that EMSs that are driven by direct demands from trade association, customers or agencies failed to ensure excellence. As firms adopt and implement an EMS to strengthen and to improve environmental performance, they are also motivated to invest in making environmental improvements. The authors concluded that an organization could adopt and EMS without investing in environmental performance. "The level of environmental investment will vary in accordance with the ambitiousness of the goals that managers choose", the authors stated. "Firms that see environmental practices as marginal to their strategic and competitive objectives will treat EMSs as tools for external image manipulation and unimportant for internal changes. Firms with strong environmental commitments will use EMS as tool to become even stronger. "The implications of this study are that two facilities implementing an identical EMS will have different results based on the drivers for adoption and how well the EMS is integrated into the culture of the organization.

In a study presented at the Twenty-First Annual Research Conference for the Association for Public Policy Analysis and Management Fall Conference, a group of researchers studied the potential merits ISO 14001 based EMS may have in business operations. The group studied eighteen facilities EMS implementation, goals, objectives and targets, and performance. They learned that a matured system, in place for at least three years, tended to have environmental objectives and targets more integrated into the long-term environmental plans of the facility. They tend to be more significant. They also found that one of the drivers to adopt ISO 14001 was to improve facility compliance. However, their study offers suggestive indications that positive

benefits may results from ISO 14001 based EMS for the organization and for the public. (Gallagher, Darnall, Andrews 10-15).

A study of 400 firms in Canada analyzed the relationship between environmental commitment and the managerial perceptions of stakeholder importance. The results of this study indicated that firms that have more proactive environmental practice differ from others in how they perceived the importance of difference stakeholders (Henriques and Sadorsky).

David A. Jones, Director of EHS at FMC Energy Systems, found that based on personal experience and after reviewing audits and investigations system, EHS Management system fail to achieve expectations due to lack of proper design (Jones). Among the deficiencies or inadequacies typically found were:

- Lack of understanding of the intent of the requirements.
- Lack of understanding that existing performance-based regulations and industry standards represent ONLY a partial set of requirements for an effective EH&S management system.
- Lack of planning in designing a management system for proper implementation and control
- Managing EHS independently, without integrating it to other elements or processes.
- Having a management system in itself does not guarantee improvements on performance. As Jones pointed it the system must meet the needs of the organization. In order to do that the system must be properly designed (Jones).

In a research compendium published by the Environmental Law Institute, the research findings from the National Database on Environmental Management System Database (NDMES) are summarized. This data is one of the most comprehensive databases on EMS available and is currently funded by the US.EPA. The main question that researchers aim to answer with the

longitudinal study is how the implementation of EMS changes a facility's behavior in six areas: management systems, environmental performance, regulatory compliance, economic performance, pollution prevention and interested party involvement (UNC and ELI 1-6). Some of the most significant findings as it relates to this project are discussed below:

- In terms of drivers and motivators to implement EMS, corporate policies play a crucial role. The researchers found that eighty-nine percent of publicly traded corporations adopted EMS and sixty-seven percent of privately owned companies that were required by companies to adopt the EMS by their parent organization.
- The researchers found that regulatory expectation was the strongest external driver for EMS implantation. The anticipation of regulatory benefits had one of the greatest influences.
- Customer pressures from both domestic and international customers had a strong influence in publicly traded facilities.
- Internal drivers are more important than external drivers. Internal drivers are management capabilities and organization culture. Outcomes and benefits of EMS adoption have not been yet determined and this work indicates that this will be addressed in a future phase of the research project.

### *3.2 Current Issues and Trends*

ACC believes that RCMS and RC-14001 certifications will give more credibility to the chemical industry. Currently, the ACC is undergoing negotiations with EPA, OSHA and state officials in New Jersey and Texas to determine what type of incentive or regulatory relief will be available for ACC members (Sissell, *Certifying*).

An effective design of EHS management system will provide the basis for ensuring that performance objectives are translated into a set of requirements or a design specification and it provides the means for communicating the who, what, when, where and why, during the process of implementation. It also provides the mechanism for updating or changing as requirements, objectives, organization and technology changes (Jones).

On his article "Thinking Big, Even if You're Small", Dan Rocniak, director of ACC Responsible Care, highlights lessons learned by small-chemical facility during implementation. The recommendations are based on the experiences of Tomah Products, a small-chemical company that manufacturers specialty surfactants. The article recommends some implementation strategies:

- Integration with other management systems such as ISO 9001 or quality systems. Examples of integration include policy, managements review, internal audits, corrective actions and goals.
- "*Don't recreate the wheel*". Taking advantage of what you are currently doing and documented.
- "*Share the Load and make it a priority*". Make sure that as many people from the organization are involved (Rocniak 14-15)

ISO 14001 and RC-14001 at Chemical Sites

The chemical industry has been lagging in terms of implementation of ISO 14001. Table 2 show the top five industries that have obtained ISO 14001 certification. Figure 8 shows the number of ISO 14001 certificates issued in the United States by the end of 2003. In 2002, Barmasse conducted a study of the feasibility of implementing ISO 14001 in small US chemical facilities. For this study, he conducted several interviews and a literature review. His conclusion was that small chemical facilities are waiting for more pressure and drivers to implement ISO 14001. He identified in his research the concern by small facilities about their resources needed for implementation and how those resources may be competing with the resources to implement and maintain Responsible Care requirements (Barmasse, 73-77).

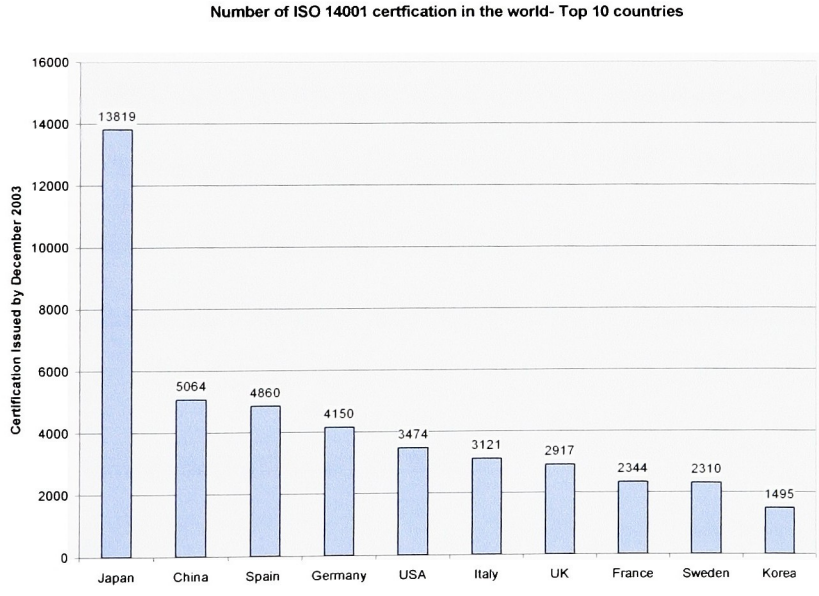


**Figure 8. Number of ISO 14001 certifications in the world-Top 10 countries (Peglau)**

| Industry | SIC | Number of ISO 14001 Certifications. |
|---|---|---|
| Transportation Equipment | 3700 | 263 |
| Rubber and Miscellaneous Plastics products | 3000 | 202 |
| Fabricated Metal Products, except machinery and Transportation Equipment | 3400 | 155 |
| Electronic and Electrical Equipment and Components | 3600 | 154 |
| Industrial and Commercial Machinery and Computer Equipment | 3500 | 140 |

**Table 2 Top Five SIC Codes with holding ISO 14001 Certifications (QSU Publications)**

The Indian Petrochemicals Limited Corporation (IPLC) shared their experience of implementing an Environmental Management System designed to meet the ISO 14001 requirements at its Nagothane complex in India in an article published in ISO Management Systems. The authors, IPLC officials, shared their implementation experience and the results that they obtained. IPLC is a manufacturer of polymers, intermediate chemicals, and catalysts among other products. The complex achieved certification in 2000. The authors felt that ISO 14001 provided a framework to integrate environmental management process with day-to day activities (Ravikumar, Selukar and Bansal 43-45). IPLC focused its environmental management around five core areas:

- Commitment to Environmental Policy
- Planning
- Implementation
- Measurement and Evaluation
- Review and Improvement.

One of the most critical areas, as identified by the IPLC employees, was the planning core area. To meet the ISO 14001 standard requirements the company assembled a multi-disciplinary team of 35-40 employees. During this phase the team identified and evaluated 350 aspects. These aspects were identified by environmental audits, mass flow diagrams. The team then determined which were significant. They used several criteria to classify their aspects, and among them were: regulations and laws, impacts, wastage of resources, interested parties, frequency, control and preventative mechanism. After that evaluation was completed the team set objectives and targets that were aligned with their environmental policy. The objectives and targets developed for the facility highlighted compliances with applicable rules, phasing out of ozone depleting substances, reuse of resources, minimizing waste, improving housekeeping, optimizing energy consumption and reducing volatile organic compounds (Ravikumar, Selukar and Bansal 45-47)

Internal audits are used by IPCL as the principal means of measuring, monitoring and evaluating their environmental performance. They are conducted every six months by trained employees (Ravikumar, Selukar and Bansal 48).

Some of the benefits that IPLC reported after ISO 14001 based EMS implementation were:

- **Enhanced employee commitment.** Now all personnel are involved in preventing pollution and conserving resources.
- **Waste reduction**. Now they see as misplaced resources. Targets of waste reduction, recycling, re-use elimination or conservation. Significant savings have resulted from this approach.
- **Information Sharing-** All plant personnel are well informed of the latest environmental development.

- **Compliance Improvements and continuous improvements.** Internal and external audits ensure that EMS requirements are met. Corrective and Preventative actions are reviewed during management reviews.
- **Documentation**- Well documented operation controls and procedure ensure consistency Ravikumar, Selukar and Bansal 47-48)

The authors stated that ISO 14001 based EMS can help market share because certified companies are seen as believing in "Responsible Care (Ravikumar, Selukar and Bansal 48).

Another chemical manufacturer that adopted ISO 14001 in the mid 1990s is Akzo Nobel Chemicals Inc. Their experience is highlighted in Quality Digest.com. For Akzo Nobel a critical component of their implementation was integration with other existing systems, such as with the quality management systems. Azko Nobel decided to integrate the audit of the ISO 9000 system and ISO 14001 resulting in lower cost, easier preparation and more effective use of internal audits (Hale 2).

The BASF facility in Wyandotte, Michigan was the first facility to get certified under RC-14001 and ISO 14001. This facility is a manufacturer of microcellular polyurethane and is a supplier to the automotive industry and thus required to meet the ISO 14001 requirements imposed by the automotive industry to their Tier I suppliers. BASF and many other chemical facilities have adhered to Responsible Care® Guiding Principles and Codes. However, the automobile industry has refused to accept Responsible Care® as an alternative to ISO 14001 (Sissell, *Industry Debuts* 51-52).

In an article published by the ACC, Amy DuVall, highlights some of the lessons learned from BASF's elastocell business as it implemented RC 14001. BASF found several opportunities to integrate several previously segregated management systems and to streamline

several processes creating opportunities to save time and money. The article does not outline how this was accomplished. However, it does point out that a diverse team was put together that included environmental, health, safety, ecology, community relations, shipping, security, regulatory compliance, and purchasing. The article highlights that BASF found ways to improved communications with the surrounding communities and received positive feedback on Responsible Care and RC 14001 efforts.

The director of BASF Corporate Quality, Wendy Finnerty, when asked to compare ISO 14001 and RC-14001, described them as "ISO 14001 is much deeper but Responsible Care included so much more." (Sissell, *Industry Debuts* 51-52). One of the major differences between ISO 14001 and Responsible Care®(RC-14001) is the specific inclusion of health and safety requirements, indicated Patricia Fitzgerald, ISO 14001 program director of ABS Quality Evaluation, which was the first registrar to become certified to audit against the RC-14001 standard (Sissell, *Industry Debuts* 51-52).

BASF indicated that it had most of the elements required by the RC-14001 technical specification, but the team had to combine them into one management system. Finnerty indicated that it was helpful to use the existing framework for QS-9000, which helped with documentation requirements (Sissell, *ACC* 49-50).

The second facility to obtain RC-14001 and ISO 14001 certifications was Arch Chemicals, Inc. in Rochester, NY. This facility obtained their certification in December 2003. This facility manufactures specialty chemicals used in personal care products, paints and building related products. This facility had already in place a mature Responsible Care program prior to the implementation of RC-14001. To meet the requirements of the RC-14001 technical specifications, the facility built upon existing programs and systems, such as its Community

Outreach programs, the quality management systems, and Process Safety Management (PSM) systems. For this facility some of the critical areas that required additional focus were the identification and evaluation of aspects and impacts, developing monitoring and measurement processes for some of their new activities. Some of the benefits reported by this facility were greater awareness among employees of requirements related to their jobs, enhanced practices and community recognition (Yohonn7-9).

The auditors and trainers for RC 14001involved with the initial RC-14001 certifications had the following observations in an article published in April 2004 (Verrico, Gillen and Ochsenkuehn). Important lessons from initial implementations are:

- Management commitment is critical. In order to succeed in implementation of RCMS, the commitment must be at the top and should involve multiple levels of employees.
- Building a system to improve performance. A system must be designed and structured in a way that promotes continual improvement.
- "Improved performance is achieved only when an organization is focused on continual improvement, demonstrates employee involvement at all levels, and truly shows planned, focused efforts towards achieving the tenets of the Guiding Principles of Responsible Care."
- Cross functional involvement is critical. Others groups and departments must be involved besides the typical EHS or Responsible Care department.

Globalization and its impact on Responsible Care

An article published in Chemistry Business, outlined some of the emerging trends on the political, business and public policy arena. These trends impacted the way that the chemical

industry addresses social and environmental expectations (Charlton and Ambrose 5-7). The article highlights some of the trends:

"The industry is facing long-term structural changes that are the results of maturing products and increased Asian and emerging Middle Eastern competition, particularly from China (Charlton and Ambrose 5-7). Globally, the U.S. chemical industry is expected to continue expanding overseas at rate greater than expected domestically, with the largest growth in Asia and the fastest growing producing bases in Asia and the Middle East(Charlton and Ambrose 5-7). On the other hand, Asian and Chinese companies will continue to expand into the US Market. These factors, the author highlights, will force companies to restructure and to implement strategies leading to asset reduction, contract manufacturing (Charlton and Ambrose 5).

In the public policy arena, there is more pressure from government and non-government agencies to focus more on the health effects of products, to create greater transparency and have product information disclosed. As the market globalization continues to increase, the focus in sustainability increases. As quoted in the article sustainability refers to "development that meets the needs of the present without compromising the ability of future generation to their own needs". This definition is knows as the Brundtland definition.

In 2003 the American Chemistry Council established a committee to work in harmonizing Responsible Care requirements among the different countries and parts of the world that have adopted Responsible Care. Responsible Care has been adopted in over 40 countries. Some of the strategies for this review are included harmonizing requirements, evaluating performance and verification requirements. Some of the key goals are to define the relationship between Responsible Care and Sustainable development Campbell, Global Strategic Review, 19-20)

ACC Vision for Responsible Care

The article also points that ACC is working in several initiatives to create more value for its members. Some of the initiatives are highlighted below:

The US. Coast Guard recently accepted Responsible as an acceptable alternative security program (ASP) under the Maritime Transportation Security Act which required specific security requirements for facilities.

ACC already has signed an agreement with the EPA that will facilitate a streamline application to the EPA's Performance Track program. This program provides regulatory relief to companies that have adopted Environmental Management Systems (Sissell, *Responsible Care* 21). ACC is pursuing other opportunities to increase the value of Responsible Care to its members. One of the initiatives started related to the Department of Homeland Security's Customs Trade Partnership Against Terrorism (C-TPAT). ACC has been trying to negotiate with US Customs to get recognition for Responsible Care efforts allow ACC members move their shipments faster through inspections. Also ACC has been approaching insurance companies for lower insurance rates by demonstrating that Responsible Care is effective in managing and reducing risks (Sissell, *Responsible Care* 21)

In an article, Mike E. Campbell, former ACC's Board Committee Chair of Responsible Care, outlined some of the current initiatives that ACC is currently working on: working with OSHA to streamline auditing requirements between Responsible Care and the VPP program and using Responsible Care to leverage added security protections with the Customs-Trade Partnership Against terrorism (C-TPAT).

### *3.3 Conclusions of Problem*

Although, there is no research currently published about RC-14001, there are several studies that relate to the objectives of this study. Several studies (U.S. PIRG, King and Lenox) highlighted the current gap in the performance of ACC members adhering to Responsible Care. The superior EHS performance is not shown for ACC members.

The ACC recognized the gap between stakeholders' expectations and actual EHS performance number. It also has recognized the need to be more transparent and credible to create value for Responsible Care for its members. The change towards management system to improve performance implementation is supported by several studies as an effective strategy (EPA, Salomon and Mihelcic, Iannuzzi).

However, the implementation of an Environmental Management System does not guarantee performance improvements. Several studies seem to indicate that positive changes in organizational behavior may lead to EHS improvements (UNC and ELI). Jones's presentation argued that lack of proper design of an EMS is a strong contributor in a system not being as effective as expected.

One of the key factors for positive EMS outcomes is the integration of this system with other existing business systems. RC 14001 and ISO 14001 implementation at chemical sites has demonstrated to be create positive changes in key functions of the organization. In the following chapters, the effect of RC-14001 implementation on key activities such as employee involvement, management systems, management commitment and understanding of applicable regulations will be studied and analyzed.

## 4.0 Methodology

(Adapted, in part, with permission from Morelli, John, "ISO 14000: A Catalyst for Reinventing EPA" doctoral dissertation, UMI).

This research aimed to identify how the implementation of an Environmental Management System (EMS), designed to meet the requirements of RC 14001, improves performance of activities that have been identified as contributors to meeting regulatory requirements and improving environmental, health and safety performance. For this type of study, qualitative research methodologies were best suited. A case study approach was found to best suited to achieve the objectives of this study. The two basic methods used to produce the best results for collecting data were a semi-structured interview format and a literature review.

In the section below, the sampling strategy is discussed along with the protocol logistics and the human subject protection measures. In the following section, the coding and analysis of data is discussed. That discussion includes the efforts made to ensure the consistency of the results as well as to ensure the validity of the data.

### *4.1 Research Design*

A literature review was first conducted to identify key individuals and organizations for this study. The literature review included journals, online databases, industry magazines, industry trade associations' publications and meeting minutes, presentations/workshops, dissertations and conference papers. The researcher gained assessed to the information through the use of Internet Search Engines, such as Google and AltaVista. The researcher used the Rochester Institute of Technology Wallace Library's resources. Those resources included the used of several online databases to obtain electronic copies of articles, and dissertation abstracts.

The University of Rochester Library and the researcher's personal library were used to complete the literature review.

Sampling Strategy- The researcher contacted the American Chemistry Council to obtain a list of the organizations with RC14001 certifications and to identify those individuals and organizations that needed to be interviewed.

4.1.1 Protocol and Logistics for Interviews

The researcher prepared for the interview by researching information connecting the interviewee with the research study. The researcher then called the interviewee and described the researcher's status as MS candidate and an environmental, health and safety professional. The researcher then briefly explained the researcher's interest on RC 14001 implementation and its impact on four main activities:

a. Employee Involvement
b. Improvement of EMS
c. Management Commitment
d. Improvement of understanding of applicable regulations.

Then the researcher explained the interview process and indicated that the company responses would be kept confidential at company's request; only generic references would be mentioned.

### 4.1.2 Human Subject Protection

Where applicable, in advance of the interview, the researcher provided each interviewee with a written statement introducing and providing the rationale for the research project, and describing the semi-structured interview procedure to be used by the researcher. In advance of the interview, provide each interviewee with background information on the researcher, and explain that the interviewee may request that any part of the interviewee response be kept confidential or off the record.

### *4.2 Coding and Analysis*

The information gathered through the literature review and interviews was evaluated and organized into one of the following seven categories:

- Responsible Care® Information
- Gap Analysis of Responsible Care® .
- Comparison of Responsible Care® and ISO 14001
- EMS Information
- RC 14001 Information
- RC 14001 Implementation Results
- Chemical Industry EHS performance

The findings were analyzed and compared to build consensus and to formulate supported findings. The researchers made attempts to resolve differences between the literature reviews and interviews, by further research or interviews. The results and analysis sections will note any divergence that was not resolved. The researcher also included her own professional work experience as an EHS professional at a RC-14001 certified facility for comparison purposes.

#### 4.2.1 Reliability

Inconsistencies in the application of research methodologies pose the greatest threat to reliability in qualitative research. To prevent or reduce inconsistencies the following steps were taken:

- Notes were expanded as soon as possible.

- The interviewer reviewed field notes as soon as possible after each interview and elaborate upon areas needing additional detail. The interviewer annotated notes, comments and references to other corresponding text within 48 hours or less if possible.
- Developed and implemented a consistent interview guide. The interview guide is outlined in the following sub-section.

*4.2.1.1 Interview Guide*

The best fit for this type of research is a semi-structured interview. However, there are several challenges that the researcher considered during each interview; such as consistency of understanding of questions, maintenance of the natural flow of information and minimization of inconsistencies. The researcher utilized the following interview guide for conducting a semi-structured, informant driven interview:

- *Establish rapport*

  It was critical for the researcher to engage the interviewees and to create a safe environment where they could express their feelings, opinions and knowledge. The researched aimed to create this rapport by engaging in casual conversation and reviewing the purpose of the researcher. The researcher used the following techniques to achieve her goal:

  - Spoke and acted in ways that were non-threatening, and
  - Cultivated a relatively neutral role.

- *Open-Ended Questions*

  The researcher asked the following questions:

***A. What was the driver(s) for implementing a environmental management system and seeking RC-14001 certification?***

The rationale for this question is to establish the framework for the organization decision making process about their implementation of an EMS and RC-14001 certification. The aim for this question is to identify drivers for the implementation.

***B. At this time, what is your impression of how RC 14001, impacted the following areas of your facility?***

- **Employee Involvement**-Provide examples.
- **Improvement of EMS.** Areas of Focus for this question.
    i. Documentation
    ii. Integration with other business systems
    iii. Corrective Action and Preventive Actions.
- **Management Commitment**. Is it more clearly defined? How is it demonstrated?
- **Understanding of applicable regulations**. Provide examples.

The rationale for this question and its subset was to directly correlate this impact of the implementation of EMS, designed to meet RC-14001 requirements, to the specific four activities that are the focus of this study.

***C. Do you feel that the implementation of management system (RC-14001 certified) has effected your EHS compliance and performance? Please provide examples.***

The rationale for this question was to investigate what, if any, improvements are already observed by the interviewee.

***C. How are EHS improvements measured?***

The rationale for this question was to obtain information about the organization's metrics as well as to obtain data that may be useful for comparison between interviewees and support EHS improvements.

- *Follow-up Questions*

As needed, the researcher conducted additional probing questions with the purpose of clarifying or confirming a statement.

Since the understanding of each questions may vary from each interviewee, the researcher aimed for consistency of understanding of the questions. To the extent possible and without disrupting the natural flow of conversation, the researcher followed the prescribed interview schedule.

### 4.2.2. Validity

The validity of a research effort is a measure of the extent to which the findings and conclusions of the work accurately explained the activity under study, and it asks whether the right thing is being measured.

Validity of this research data was established, by carefully identifying and evaluating competing interpretations of the data. The researcher has chosen the triangulation and quitting the field methodologies. Both methodologies are explained below.

#### *4.2.2.1 Triangulation*

This method compared multiple sources of information about an object of inquiry. Data may be derived from multiple use of a single method (E.g. in –depth interviews), single (or multiple) use of multiple methods (e.g. interviews and examination of archival texts). Triangulation provided both a credible means of verifying data and of developing concepts. The use of multiple methods is the most common approach to triangulation research text. In the most common approach, explanation derived from one method, from among those employed, then are enriched or qualified by text generated using complementary methods.

*Quitting the Field*

When new data was consistent with the hypothesis or explanation, required no modification and provided no new surprises, the researcher concluded that the study had reached a point of theoretical saturation and ended the project.

This work ended when a point of diminishing returns was reached to the extent that new information duplicates what already is known and no significant modification to the hypothesis or explanation was required.

## 5.0 Results

This study aimed to examine the impact of implementing an environmental management system (RC-14001 certified) will have on activities that have been associated with improved Environmental, Health and Safety performance and compliance. Through the literature review, the researcher learned of factors that influence the outcomes of implementation of Environmental Management system. These factors have been categorized in four main activities:

- Employee Involvement
- Improvement on Overall Management System
- Management Commitment
- Understanding of Applicable Regulations.

The researcher utilized two basic methods for the collection of data to achieve the study objectives: literature review and case study. The researcher contacted the American Chemistry Council to obtain information about certified facilities. At the time of this study, four companies had attained RC-14001. The four companies are listed in Figure 9.

**RC 14001 Certified Facilities as of July 2004**

*Arch Chemicals, Inc.*, Rochester, NY- a specialty chemical manufacturing facility. An ISO 9001:2000certified facility.

*BASF*, Wyandotte, MI -A manufacturer of 'celasto' or elastocells, a component of automobile of shock absorbers. A QS 9000 certified facility.

*Marathon Ashland, LLC*, Detroit, MI- a refinery facility.

*Mead Westvaco*, Covington, VA- A specialty chemical facility. It manufactures activated powdered charcoal used in catalytic converters. A QS 9000 certified facility. This company has a second site in Kentucky that has obtained RC-14001 and QS 9000 certifications recently.

**Figure 9 RC 140001 Certified Facilities**

For consistency and validity, the researcher requested interviewees with EHS professionals at the facility that were involved with the implementation of the EMS or RCMS. Three of the four companies agreed to the interviews. The companies interviewed were: BASF, Marathon Ashland and Mead Westvaco. In the following sections, the responses from the interviewed facilities are summarized by topic and questions.

### *5.1 Case: Drivers for Implementation of RC-14001*

*What was the driver(s) for implementing a environmental management system and seeking RC-14001 certification?*

Two of the facilities indicated that their driver in obtaining RC-14001 was their customers requiring them to obtain ISO 14001 certification. They both felt since they already have Responsible Care in place that the best route to satisfy their customer requirements was to design their EMS to meet the RC-14001 Technical Specification and seek dual certification in RC-14001 and ISO 14001.

The third facility had just initiated the implementation of Responsible Care at its site when the ACC introduced RC-14001. The facility decided to design their management system to meet RC-14001 and seek dual certification because ISO-14001 was more easily recognized in their community as sign of a strong commitment to the environment. The company representative also indicated that the facility is currently under expansion, and seeking changes in their environmental permits. He felt that having an ISO 14001 certification will help answer questions about their environmental management practices during public meetings.

### *5.2 Case: Impact on Employee Involvement*

*What are your impressions on how RC 14001, impacted employee involvement at your facility?*

All three facilities indicated that they had programs in place that addressed employee participation and involvement, prior to the implementation of their EMS or RCMS.

Two of the facilities that were regulated under OSHA's Process Safety Management of Highly Hazardous Chemicals regulations (PSM). These two facilities indicated that they already had a mature employee participation program. One of these facilities indicated that the RC 14001 implementation increased awareness of the aspects and impacts associated with their operations and activities. Prior to implementation, the employees' focus was on meeting air limits, water limits and ensuring that waste was properly manifested. Now, the company reported, employees are asking questions such as: Why are we producing this waste? Why there is much dust in the dust collectors? These discussions have generated ideas by employees on how to minimize the waste. Some suggestions have implemented and have resulted effective in reducing waste. Other suggestions have not been found to be feasible. However, the company representative indicated that without the discussions about aspects and impacts they would have not consider these suggestions would have not been generated. The second company regulated by PSM regulations indicated minimal changes in employee involvement after RCMS implementation.

The third facility indicated that they also had programs that addressed employee involvement through their quality program, safety programs and safety committees. However, they felt that the RC management system helps bring all those programs under the same umbrella. It also helped employees be more aware of the impact that their jobs have on the environmental, health and safety.

### *5.3 Case: Impact on Overall Management Systems*

*What are your impressions on how RC 14001, impacted your overall management system at your facility?*

#### 5.3.1. Documentation

One of the facilities indicated that the most significant impact of implementing a management system to meet the specifications of RC-14001 was in document control. The facility indicated that prior to implementation of the management systems, changes to documents were made manually and documents were not stored or controlled systematically. As an example, the company representative indicated that at the beginning of implementation he searched for an incident investigation procedures and found six (6) different versions stored in the network. Now, he indicated the document are control in secured files ensuring that the document used is the updated most recent version.

The other two facilities reported minimal changes after the implementation of RC-14001. One of the facilities implemented the use of software to document and follow-up corrective and preventative actions. The other facility indicated that documentation improved goals, aspects and impacts. This facility indicated that the documentation system used was the same as the Quality system.

#### 5.3.2 Integration with Other Business Systems

One of the facilities reported that RC 14001 is being used as a template for quality accounting and financial planning. New requirements in accounting required by the Sarbanes-Oxley Act of 2002 are being integrated in the system developed for RC 14001.

The other two facilities already had a quality management system in place. Both facilities were certified in ISO 9001:2000. For one of the facilities, the EHS manager was also the Quality manager. In this facility the processes for dealing with nonconformance, Corrective Action and Preventative Actions (CAPAs), internal audits and document controls were the same for Quality and Responsible Care. However, the facility developed a separate Responsible Care Manual and requested Division personnel to document some of the processes used to provide updates in Environmental, Health and Safety regulations.

The second facility with a certified quality management system also integrated Responsible Care processes with quality processes. The most significant integration, the company representative reported, was the integration of Responsible Care in the goal setting process.

### 5.3.3 Corrective Action and Preventative Actions

The three facilities interviewed reported already having a system in place for addressing corrective and preventative actions (CAPAs). One facility reported no change in the way that CAPAs were addressed after the implementation for RC-14001.

The other two facilities reported some improvements. One of the facilities reported using RC-14001 implementation for the justification of purchasing software that assisted in the follow-up and tracking of CAPAs. The second facility reporting improvements reported that improvements have been significant. Prior to the implementation of RC-14001, and establishing a process for tracking and measuring completion of CAPAs, the facility had difficulties completing incident investigations in timely manner and completing the corrective actions

associated with incidents. The lag time was between 6 months to 1-2 years between the deadlines set by the facility and the completion of CAPAs.

### 5.3.4 Other Impacts on Management Systems

The facilities reported additional impacts on their management system not outlined above. Two of the facilities reported that the implementation of RC-14001 strengthened their community and employee outreach programs.

One of the facilities reported that the implementation of RC-14001 and the analysis of its aspects and impacts encouraged the facility to set stretch goals. This facility also found that the implementation of RC-14001 was difficult in the areas of Distribution and Product Stewardship due to large number of customers. The implementation of RC-14001 helped strengthen those two areas of their existing Responsible Care program.

### *5.4 Case: Impact on Management Commitment*

*What are your impressions on how RC 14001, impacted management commitment at your facility?*

Two of the facilities reported that the implementation of RC-14001 brought no change to the management commitment at their facility. Both facilities reported that the driver to seek the dual certification of RC -14001 and ISO -14001 was to meet their customers' requirements. Both facilities are supplier to the 'Big Three' U.S. automotive manufacturers. They also report that no additional resources have been committed to the maintenance of their management systems. The two facilities reported that the requirements of Responsible Care were not new to the facility or its employees.

The third facility reported significant changes. When the company representative was asked how the management commitment is demonstrated and to report changes, the representative indicated that the most significant changes represented are the monthly management review meeting and the weekly review of EHS measures. The representative says that is clear is that everyone is being held accountable and everyone know that they will have to explain why a task was not completed within the agreed time. The focus of this meeting, he says, is 'what get measured gets done.'

### *5.5 Case: Understanding of Applicable Regulations*

*What are your impressions on how RC 14001, impacted understanding of applicable regulations at your facility?*

Two of the facilities reported no changes in their understanding of applicable regulations. They both reported that they have had sophisticated system to track the applicable regulations to their facilities and processes that keep them informed of new regulations or changes to existing ones. They also reported that their employees are aware of the requirements related to their jobs and is incorporating into the employee training.

The third facility reported that there was not much improvement at the federal level. He indicated that facility is heavily regulated and they were already aware of the federal requirements. However, he indicated that as a result of the implementation of RC-14001, they have a better understanding of state requirements.

### *5.6 Case: RC-14001 Implementation effect on EHS compliance and performance.*

*Do you feel that the implementation of management system (RC-14001 certified) has effected your EHS compliance and performance?*

The two facilities with existing quality management system indicated that no significant changes have occurred from compliance and EHS performance. However, they indicated that identification of aspects and impacts led to identify projects to minimize their impact on the environment. One of these facilities reported that some of these projects help them keep cost down. One of the facilities indicated that one their projects is to investigate ways to minimize the natural gas consumed.

The third facility indicated that they have seen an improvement on their compliance and performance. The company representative indicated that more issues are being addressed and more deadlines are being met. He attributes this change to the facility goals and the monitoring system which requires weekly, monthly and quarterly updates. It also attributes this change to the system of audits. This facility is currently applying to EPA's Performance Track program and is also considering applying for the OSHA's Voluntary Protection Program next year.

### *5.7 Case: How are EHS improvements measured?*

- All three facilities reported using traditional metrics. All of them keep track of total injuries and illness rate (TCIIR) using the formula below:

  TCIIR= (annual number of Recordable Cases * 200,000 hours)/ (annual number of employee hours worked)

- One of the facilities indicated that measured the percentage of participation of employees in safety programs.
- All three facilities indicated that they keep track of environmental reportable incidents. One of the facilities kept track of environmental deviations. This facility noted a 20% improvement over the past three years. This facility also has as a metric the number of items past due.

### *5.8 Summary*

Two of the facilities interviewed already had management system in place that were matured and integrated business management systems. They both had mature Responsible Care programs prior to the implementation of ISO 14001. Both of them had a certified quality management system and sought RC-14001 and ISO 14001 per request from their customers. They both saw minimal changes in the actual EHS performance and compliance. However, they both report improvements driven by the identification and evaluation of their aspects and impacts.

The third facility indicated significant changes in their compliance and EHS performance. This facility underwent significant changes and improvement in their management systems. This facility was just implementing Responsible Care and found some of the requirements difficult to implement, such as the Distribution and Product Stewardship requirements.

In the following chapter these results will be discussed in more detail and any trends will be noted and analyzed.

## 6.0 Analysis and Discussion

The goal of this study was to analyze the effects of implementing a Responsible Care Management System on four activities that have been linked to EHS performance and compliance. These activities were grouped in four main categories: employee involvement, improvements on overall management systems, management commitment, and understanding of applicable regulations.

### *Employee Involvement and Management Systems*

The results indicated that implementation of RC-14001 impacted employee involvement and the organization's management systems for all three facilities. This outcome was expected since the RC-14001 Technical specification specifically required to establish processes that include employee participation and that address all aspects elements of a management system. The implementation of RC-14001 had the least impact in the two facilities that had integrated EHS with their quality management system, and had a mature Responsible Care program. These two variables, quality management systems and Responsible Care are discussed in the following paragraphs.

Another variable, in terms of impact of RC-14001 on employee involvement, was the fact that all three facilities were adhering to PSM/RMP requirements prior to the implementation of their EMS. This variable will also be discussed.

#### Quality Management Systems (QMS)

Several trends were noted in the analysis of the data. Among them, there was the impact of having a quality management system in place. Two of the facilities interviewed had obtained QMS certifications. These facilities indicated that having the quality system in place help them

with the implementation of RC 14001 and reported minimal changes or improvements to their existing system. For both of them the integration of quality, environmental, health and safety had occurred over time and progressed naturally as the resources available limit duplications of system and processes. The most significant change that these two facilities reported was in the identification and analysis of aspects and impacts. These analyses brought changes in the level of employee involvement and in the goal setting processes.

The trend of integrating Responsible Care, heath and safety is consistent with the researcher's experience at a chemical site with ISO 9001:2000, ISO 14001:1996 and RC-14001 certifications. It is also consistent with Azko Nobel experience with ISO 140001 and ISO 9001 systems.

The third facility and the only one without a quality management system found that the most significant improvements were in handling corrective and preventative actions (CAPAs), and the management of documents. This outcome is to be expected since the facility did not have other business systems addressing these two aspects. One unexpected outcome from the interviews was that the facility indicated plans of using their EMS as a template for compliance with Sarbanes-Oxley's requirements.

Maturity of Responsible Care

Two of the facilities have had Responsible Care for over a decade. One facility however was implementing Responsible Care for the first time as it was implementing RC-14001. This facility indicated that some requirements posed challenges to the facility, such as the requirements related to Product Stewardship and Distribution processes.

PSM/RMP requirements

Two of the facilities reported that they were covered under PSM and RMP requirements. Both regulations required employee participation in the safety and health processes. These facilities reported mature employee participation plan and good employee involvement, and good understanding of federal facilities. The third facility was no longer under PSM/RMP processes, but it had maintained some of the best practices associated with these regulations including management of change and employee involvement programs, such as safety committees.

***Management Commitment***

Customer Driven Certifications

Two of the facilities reported that the main and only driver to obtain RC-14001 certifications was their customers' requests for ISO -14001 certifications. Since both facilities had a mature Responsible Care, they decided that the best option for them was to implement a management system to meet the RC-14001 Technical Specification requirements. The implementation of RC-14001 did not change the resources allocated toward EHS or Responsible Care, and did not change management commitment. These facilities indicated that there were no changes in EHS performance.

This finding may be viewed as supporting Nash and Ehrenfeld findings about EMS and environmental performance results. They indicated that facilities driven by customers, trade associations, and agencies to implement EMS failed to achieve significant environmental improvements. However, the researcher feels that the other variables of concern in this matter are that the companies already had advanced and mature system in place. Both companies classified their environmental performance as good, and one reported occupational injury and

illness rates below 0.90. Not enough performance data was reviewed in this study to establish the relationship between customer driven certification and EHS performance.

Facility-Company Driven Certifications

The third facility sought RC-14001/ISO-14001 certifications because it believed that it demonstrated a strong EHS commitment to its surrounding community. This company had recently made a commitment to the Responsible Care Guiding Principles and the facility was required to implement Responsible Care. The RC-14001 Technical Specification served as the roadmap for the implementation of the Responsible Care initiative. This facility indicated that they have significant changes in their EHS performance driven by their focus on performance metrics and CAPAs.

***Understanding of Applicable Regulations***

The results indicated minimal impact of RC-14001 on the facilities' understanding of applicable regulations. One facility reported having a better understanding of state regulations; however the impact was not as significant as in other areas. All the facilities indicated that they are heavily regulated and they already have a system in place to address their legal requirements.

## 7.0 Conclusions

The objectives of this research study were to study the effects of RC-14001 implementation on activities that have been linked to compliance and improved environmental performance by previous studies (Salomon and Mihelcic, EPA and ACC). Since Responsible Care and RC-14001 also include health and safety components, this study aimed to capture the effect on how these four activities within the framework on EHS compliance and performance. The four focus areas are listed below:

- Employee Involvement
- Improvement on Overall Managements Systems
- Management Commitment
- Understanding of applicable regulations.

The results of this research indicated that the implementation of a comprehensive environmental, health and safety management system designed to meet the requirements of RC-14001 positively impacted employee involvement and overall management systems. The degree of impact of the implementation of RC-14001 for each facility was dependent on several factors and drivers. The most significant factors were the maturity of their Responsible Care Program, and their level integration of Responsible Care into existing quality management systems prior to the implementation of RC-14001. All of the facilities indicated that the assessment of aspects and impacts played a significant role in improving their existing processes; including employee participation and goal setting. The results indicated that were no significant changes in performances for facilities with matured systems in place.

This study has significant implications for facilities considering the implementation of RC-14001. This study highlights the benefits of this implementation and some key strategies; such as integration of existing business systems and processes. Based on this study's results, facilities with mature EHS systems should concentrate their efforts on the aspects and impacts determination and evaluation. This process has the greatest potential for having an impact on mature systems. Facilities with no existing business management systems, or just implementing Responsible Care, may effectively use RC-14001 as a roadmap for developing an environmental management system (EMS).

### *7.1 Summary of Contributions*

This work is the first study that looked at the effects and impacts of RC-14001 implementation on activities that contribute to EHS performance and compliance. This study supports previous study's findings (Salomon and Mihelcic) that suggest that trade association can play an important role in improving environmental compliance. Some of the implications of this research is its potential impact on policy making decision which becomes critical as the chemical industry strives for transparency and credibility.

### *7.2 Future Research*

The changes to Responsible Care are relatively recent; currently, the ACC and SOCMA members are working in the implementation of their management systems. The members currently have two options for their certifications: RCMS Technical Specification or RC-14001. The changes in performance metrics are not all implemented and not all the performance data is available as this study comes to a conclusion.

Future research is needed with a larger number of samples. A comparison of the impact of RC-14001 functional activities and the organization performance data will be useful in establishing whether or not the Responsible Care changes have resulted in actual performance changes. These results may also be used to compare to ACC and SOCMA non-members to study the impact of trade associations on EHS performance.

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## Appendix A: Responsible Care® ® Guiding Principles

## Responsible Care® ® Guiding Principles[1]

Our industry creates products and services that make life better for people around the world — both today and tomorrow. The benefits of our industry are accompanied by enduring commitments to Responsible Care® ® in the management of chemicals worldwide. We will make continuous progress toward the vision of no accidents, injuries or harm to the environment and will publicly report our global health, safety and environmental performance. We will lead our companies in ethical ways that increasingly benefit society, the economy and the environment while adhering to the following principles:

- To seek and incorporate public input regarding our products and operations.
- To provide chemicals that can be manufactured, transported, used and disposed of safely.
- To make health, safety, the environment and resource conservation critical considerations for all new and existing products and processes.
- To provide information on health or environmental risks and pursue protective measures for employees, the public and other key stakeholders.
- To work with customers, carriers, suppliers, distributors and contractors to foster the safe use, transport and disposal of chemicals.

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[1] American Chemistry Council. .Responsible Care Guiding Principles http://www.americanchemistry.com. 5 Jul 2004

- To operate our facilities in a manner that protects the environment and the health and safety of our employees and the public.
- To support education and research on the health, safety and environmental effects of our products and processes.
- To work with others to resolve problems associated with past handling and disposal practices.
- To lead in the development of responsible laws, regulations and standards that safeguard the community, workplace and environment.
- To practice Responsible Care® [8] by encouraging and assisting others to adhere to these principles and practices.

# Appendix B: Responsible Care® Performance Measures

## Performance Measures

**RESPONSIBLE CARE® PERFORMANCE METRICS**

| Performance Metric | Collection of Information by Company or ACC | Information to be Reported on Company or Industry Basis | Public Reporting Begins |
|---|---|---|---|
| ***METRICS REFLECTING RESPONSIBLE CARE ENVIRONMENT, HEALTH, SAFETY AND SECURITY PERFORMANCE*** | | | |
| 1. Pounds of TRI - air, land and water releases (reported separately) | Company | Company | 2004 |
| 2. Number of reportable distribution incidents | Company | Company | 2004 |
| 3. Number of process safety incidents | Company | Company | 2004 |
| 4.a. OSHA recordable incident rate – employees | Company | Company | 2004 |
| 4.b. OSHA recordable incident rate – contractors | Company | Company | 2005 |
| 5.a. Percent facilities completing security assessments based on Security Code schedule | Company | Industry | 2004 |
| 5.b. Percent facilities completing security enhancements/verification based on Security Code schedule | Company | Industry | 2005 |
| 6. Certification of Responsible Care® Management System ("yes"/"no") | Company | Company | 2004 (companies will have from 2004 to 2007 to complete certification) |
| **METRICS REFLECTING REPUTATION, SUSTAINABLE DEVELOPMENT, PRODUCTS AND OTHER INITIATIVES** | | | |
| 7. Greenhouse gas emissions (pounds of CO2 equivalent net emissions per pound of production) indexed to base year | Company | Industry | 2005 |
| 8. Energy efficiency (BTUs consumed per pound of production) indexed to base year | Company | Industry | 2005 |
| 9. Industry economic performance:<br><br>a. Total industry R&D investment<br>b. Total number of industry employees<br>c. Total value of industry payroll<br>d. Total value of U.S. industry net exports | ACC | Industry | 2004 |

| METRICS REFLECTING REPUTATION, SUSTAINABLE DEVELOPMENT, PRODUCTS AND OTHER INITIATIVES | | | |
|---|---|---|---|
| 10. Company has in place a documented process for characterizing and managing product risk, and a summary of the process is available to the public. ("yes"/ "no") | Company | Company | 2005 |
| 11. Company has in place a process to communicate results of the risk characterization and management process in an effort to facilitate public knowledge. ("yes"/ "no") | Company | Company | 2005 |

Source: http://www.americanchemistry.com