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Investigation of Perceptions of Environmental Management Systems and its Perceived
Importance in a Corporation undergoing ISO 14001 Certification

A thesis
presented to
the faculty of the Department of Environmental Health
East Tennessee State University

In partial fulfillment
of the requirements for the degree
Master of Science in Environmental Health

by
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August 2001

Dr. Carolyn Harvey, Chair
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Keywords: Environmental Health, ISO 14001, Bosch, Survey,
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ABSTRACT

Investigation of Perceptions of Environmental Management Systems and its Perceived Importance in a Corporation undergoing ISO 14001 Certification

by

Charlette Michelle Clark

The International Organization of Standardization (ISO) has created a series of voluntary standards (ISO 14000) that promote waste reduction and improve businesses' environmental management. ISO 14001 is the Environmental Management System portion of ISO 14000 requiring employee awareness and involvement. The Robert Bosch Corporation is undergoing ISO 14001 certification.

In this study, a 23-question survey was used to evaluate Bosch employees' awareness of ISO 14000 and their support of a waste reduction program at 4 plants (Johnson City, TN; Sumter, South Carolina; Ashland, Ohio; and South Bend, Indiana). Employees surveyed were not yet familiar with ISO 14000 and that their awareness varied across job title and location. Employees were pro-environment and supported waste reduction programs under the condition they would not be penalized financially as a result. Results of this study will be used to identify strengths and weaknesses in EMS training at the surveyed facilities.

DEDICATION

To line employees, laborers, and utilities personnel who work hard everyday without dropping the ball. To management personnel who make the effort to know the laborer behind the wheel of progress.

ACKNOWLEDGEMENTS

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CHAPTER 1

INTRODUCTION

As the expense of proper disposal and management of solid and hazardous waste increase, companies locally and globally are seeking improved environmental management procedures to curtail costs and promote waste reduction. There has been a growing realization in governments that as countries develop, a separation of economic issues from environmental issues becomes difficult (World Commission 1987). Previous legislative efforts by institutions have been successful in improving air and water quality. Unfortunately, little has been done in the area of preventing pollution processes. Much of today's potential pollution is tied into industrial processes, not the management of wastes after they have been produced (Cascio 1996). If industrial practices are designed to produce less waste, there will in effect be less spent on waste management and heightened efficiency of processes.

In 1996, the International Organization for Standardization (ISO) developed voluntarily environmental standards addressing this issue (O'Mara 1998). This standard is applicable to nearly all organizations worldwide and does not replace governmental mandated environmental regulations. Instead, it allows for a framework for defining, monitoring, controlling, and improving environmental aspects of process operations (O'Mara 1998). This standard is ISO 14001, which is part of a larger series of standards entitled ISO 14000. ISO 14000 is the generic name for a series of environmental management standards covering environmental management systems, auditing, life-cycle assessment, performance evaluation, product standards, and environmental labeling (O'Mara 1998). Although a number of companies worldwide have already implemented this new system of environmental management, the United States has been slow to participate. ISO 14001 began to be taken seriously in 1996 when Ford became the first

automobile company to certify all of their facilities worldwide (Fielding 2001). Certification of Ford's 140 facilities was complete by 1999 after which Ford announced in the fall of that year they would begin requiring their automobile parts suppliers to implement ISO 14001 (Schaarsmith 2001). Following Ford's announcement, Chrysler also began requiring the same for its suppliers. Robert Bosch Corporation is a supplier for both Ford and Chrysler. Therefore, Bosch has begun a series of internal assessments and investigations to determine what changes need to be made to pursue ISO 14001 certification.

Because ISO 14000/14001 addresses all aspects of a business, it requires that all employees be made aware of processes within the organization that have the potential to adversely impact the environment. The goal of this awareness is to transform organizational behavior to improve environmental performance over time. The final result is an ongoing process of continuous improvement. Employee awareness of ISO 14001 begins with employee knowledge of environmental management systems. Bosch, a German owned company, operates facilities around the world. Currently, all Bosch plants in North America have undergone the general awareness training stipulated under ISO 14001. The goal of general awareness training is to familiarize Bosch employees (also referred to as associates) with the basics of ISO 14000/14001. Despite differences in the regional location of each North American plant and the manufacturing processes unique to each plant, general awareness training has essentially been the same. However, there may be a difference in the interpretation and understanding of environmental management systems and its importance across the various job positions within the Bosch workforce. ISO 14001 awareness is vital to the registration process. It is imperative that all associates, regardless of function within the corporation, have a fundamental knowledge of what ISO 14001 is and how it can affect their plant. Generally, the more knowledge one has

about a system, the better that person can assess its importance. Although general ISO 14001 knowledge has been distributed among the general Bosch population, it would be helpful to know if there are innate differences between employees' knowledge and understanding between plants. Determining this and uncovering perceptions of importance of Bosch associates towards environmental programs was accomplished through a cross sectional employee survey.

Surveying has been described as one of the most frequently used methods in research (Paxson 1995). It has made important contributions to industry by informing managers of the views and opinions of the workforce. If applied meaningfully and designed carefully, surveys can be instrumental in the improvement of company processes simply by revealing strengths and weaknesses within a system. By randomly distributing a survey to employees at four Bosch facilities, information was obtained about the current knowledge and overall perspective of the ISO 14000/14001 environmental management system. Although employees have been exposed to general awareness training, the possibility exists that they are unaware of how the system can benefit their plants. If employees have a basic understanding of the fundamentals of ISO 14001, perhaps they will be more supportive of its implementation. Furthermore, the survey examined support of a company-operated waste reduction program and how this support varies when economic factors are involved. Surveys were distributed to three manufacturing plants and one non-manufacturing plant. Questions on the survey addressed factors such as personal environmental responsibility, corporate responsibility, opinion of ISO 14000/14001, and training. Survey results were tallied and examined for statistical differences between job titles, locations, and conditional support of a waste reduction program.

Objectives

The objective of this study was to determine Bosch employees' awareness of the ISO 14000/14001 environmental management system and to assess their opinion in regards to environmental management. This objective was accomplished with the following hypotheses:

- 1) ISO 14000 is perceived as a viable asset to Bosch employees in Ohio, Indiana, Tennessee, and South Carolina.
- 2) There is no statistically significant difference between job title and perception of implementation of ISO 14000 at the four Bosch locations.
- 3) There is no statistically significant difference in the employees' knowledge and understanding of environmental management systems between Bosch plants.
- 4) There is no statistically significant difference in employee support of a company operated waste reduction program when there are economic benefits as opposed to no economic benefits.

Significance

Completion of this study helped to identify differences in the attitudes of associates in four plants located in North America and revealed differing knowledge of ISO 14000/14001 across the various positions within the company. The study was not designed to evaluate employees' detailed knowledge of the system but to detect their general awareness, a requirement for ISO 14001 certification. An assessment of employee familiarity was made through a survey analysis. My thesis project included a survey study of 4 plants owned and operated by Bosch. The study was not designed to detect specifically each employee's knowledge of the system. Completion of this study helped to identify differences between the attitudes of management and non-management Bosch employees. Although the survey results only showed a snap shot in time of four regionally different plants, as Bosch continues making

progress in ISO 14001, it could be modified and used in the future to identify changes in attitudes and values. Results of this survey were helpful in tracking Bosch employees' knowledge of ISO 14001 as Bosch joins the ranks of other companies, both national and international, developing a proactive environmental management system.

CHAPTER 2

LITERATURE REVIEW

The Global Need for an International Environmental Management System

As costs of solid and hazardous waste disposal and management increase, the demand for an efficient, long-term environmental management system grows with the earth's expanding population. This demand has surfaced simultaneously in small businesses and larger corporations world wide. As economic growth propels the world into new technological and industrial developments, there exists an international demand on common resources. Many forms of development erode the environmental resources upon which they must be based, causing environmental degradation and weakening economic development (World Commission 1987).

In a report published by the World Commission in 1987, it was stated that poverty is a major cause and effect of global environmental problems. This statement was based upon the fact that environmental stresses increase with economic growth due to the strain on resources (1987). When one nation experiences a depletion of resources, a strain is placed on other countries in efforts to provide assistance. The World Commission aptly stated "no country can develop in isolation from others" (1987). If proper management of resources is practiced on a national scale, it is likely that provision can be made for more improved economic growth. It is futile to attempt to deal with environmental problems without a broader perspective that encompasses the factors underlying world poverty and international inequality (World Commission 1987).

In realization of this fact, there is a need for effective international organizations to involve institutionally and politically separated systems. Many governmental systems have had great success in improving air and water quality and enhancing the development of natural resources. The United States has passed extensive legislation designed to protect bodies of water and other resources (i.e. Clean Air Act, Solid Waste Disposal Act, Resource Conservation and Recovery Act, Clean Water Act). However, the bulk of environmental achievements have been after-the-fact-repair of damage: “reforestation, reclaiming desert lands, rebuilding urban environments” (World Commission 1987). Post damage remediation efforts do little to involve the perpetrators of global resource mismanagement. The world of interlocked economic and ecological systems will not change; the policies and institutions concerned must (World Commission 1987).

International Environmental Policy

A new international approach is required that provides a new type of development, integrating production with resource conservation and enhancement (World Commission 1987). Unfortunately, there are a number of conditions deterring the involvement of a successful international policy. For instance, there exists many independent jurisdictions whose decisions require coordination of the common-property characteristics of a substantial portion of the world’s resources (Baumol 1979). Neither the demand nor the control of these resources (i.e. water, air, energy, land) is restricted to one economy or system. However, consideration must be given to their universal consumption and distribution for an agreed upon balance.

This absence of international cooperation leads to mistrust and apprehension. There is the fear that the costs of an aggressive domestic program of pollution control will result in higher

export prices, loss of world markets, deterioration in the balance of payments, and an accompanying loss of jobs and income (Baumol 1979). The thought of the threat of competitive disadvantage that pollution control may impose on a nation's export-and import-competing industries has often stifled attempts to introduce effective environmental-management programs (Baumol 1979). Underdeveloped areas have demonstrated resistance to instituting strong pollution measures for fear that their economic growth will be slowed. The result has been a continuing abuse of international waters, air, and surrounding areas (Baumol 1979).

Approaches to Environmental Policy

Since the 1970s, environmental regulatory programs have developed unsystematically and with little regard to potential impacts. They have tended to emphasize prevention of the most obvious and immediate sources of damage and have neglected other less visible, but possibly more damaging, sources (Baumol 1979). Baumol states that current environmental policy does not consistently satisfy the basic requirements for a rational ordering of priorities (1979). Logical strategy in environmental damage reduction prioritizes the elimination of pollution sources according to cost and difficulty of removal. After the exclusion of relatively manageable and inexpensive contamination sources, further pollution reductions generally prove to be more costly and difficult. This increase in cost is because current methods address the pollution itself and not necessarily the process.

Baumol classifies the policy instruments used for the preservation of environmental quality into four broad categories. The first 3 are techniques used to influence behavior: "moral suasion, direct controls (regulation), and methods that rely on market processes (price incentives)" (1979). The 4th approach involves direct government expenditure, drawing from

funds provided by the public to provide an operation usable by the masses. An example provided by Baumol, for the control of water pollution, displays an implementation of the four:

1. Appeals to polluters to cut back, or eliminate altogether, their waste discharges for the sake of the public welfare;
2. Laws requiring polluters to cut back emissions or to institute specified treatment procedures;
3. The enforcement of effluent charges or taxes on polluters, where the fee varies directly with the level of emissions; or
4. The construction, at public expense, of waste-treatment facilities to decrease the emissions from private industry and households.

(Baumol 1979)

There are relatively few situations in which moral pressure alone proves successful as an effective means of dealing with environmental problems. Taxes, subsidies, the sale of permits, and refundable deposits are the major techniques that use price incentives for the control of environmental quality (Baumol 1979). While many economists believe that market incentives are the most effective alternatives, direct controls are used most often for environmental protection and are the measures favored among legislators and regulators. In most countries, including the United States, environmental authorities have relied primarily on direct controls to regulate the polluting activities of private industry and individuals. Direct controls may prohibit certain forms of pollution or place limits on waste emissions or other damaging acts (Baumol 1979).

Until recently, the government has had the sole responsibility for setting standards for industrial environmental emissions as well as monitoring companies to ensure adequate pollution control. In the United States, the Environmental Protection Agency (EPA 2000a) has conducted numerous inspections and established regulatory procedures to address industrial pollution. However, with current production growth trends and a decreasing budget, the EPA's ability to monitor industry has become very limited. Much of the potential pollution is tied into processes of industry, not the management of wastes after they have been produced (Cascio 1996). If

industrial processes are designed to produce less waste, then there will be less spent on waste management and perhaps a decrease in permits required for that particular operation. The EPA has neither the resources nor the expertise to dictate the design of industrial processes. This is true not only for the United States, but for most countries. The responsibility of action for pollution prevention has fallen upon individual companies.

ISO 14000/14001

Recognizing the need for global practices of waste reduction starting at the production level, the International Organization for Standardization (ISO), consisting of representatives from industry, government, non-government organizations, and other entities, finalized the ISO 14001 standard in September 1996 (Cascio 1996). The purpose of this standard is to produce a uniform framework for an environmental management system (EMS), one that can be applied to various applications across the world. ISO 14001 is one of several environmental guides described under ISO 14000. ISO 14001 is unique among the other ISO 14000 standards in that it can be objectively audited against for internal evaluation purposes or by a third party for certification purposes (Sala 1998). ISO 14001 certification is voluntary and does not guarantee improved environmental performance. However, it does provide guidelines for companies seeking to reduce their impact on the environment.

The International Organization for Standardization (ISO) was established in 1947 to promote standards in international trade, communications, and manufacturing. It is not government controlled nor does it have the power to impose standards (Goetsch 2000). It originally dealt with quality systems (QS 9000) but has since expanded. ISO 14000 addresses

how the quality of an environmental management system is established and executed (Goetsch 2000). The overall aim of this International Standard is to support environmental protection and prevention of pollution while balancing socioeconomic needs and is accomplished by setting guidelines by which an EMS is structured (Goetsch 2000). The scope of ISO 14000 is as follows:

“...specifies requirements for an environmental management system, to enable an organization to formulate a policy and objectives taking into account legislative requirements and information about significant environmental impacts. It applies to those environmental aspects that the organization can control and over which it can be expected to have an influence. It does not itself state environmental performance criteria.”

(Goetsch 2000).

The 14001 EMS consists of several major principles: an environmental policy, planning, implementation and operation, checking and corrective action, management review and continual improvement (Sala 1998). Although no organization is forced to implement ISO 14000 (or ISO 14001), several businesses have already begun stressing the importance of establishing a well organized EMS. Within the last decade this trend has become a global movement as European companies have taken on an even greater responsibility for environmental management. This voluntary participation has acquired support from corporations world wide as well as from local government entities (Figure 1). The EMAS, European Eco-Management and Audit Scheme, is another voluntary initiative designed to encourage environmental responsibility among businesses (IEMA 2001). The EMAS is similar to ISO 14001 in that it establishes specifications for environmental management systems of companies doing business with the European Union.

The EPA has been requiring companies with previous compliance problems to develop an EMS upon the settlement of enforcement cases (EPA 2000b) and participates in the trend of

voluntary source reduction and pollution prevention. The EPA has voiced support of voluntary programs because a company's implementation of an EMS has the potential to improve an organization's environmental compliance with regulatory requirements (Dufresne 2000). The EPA encourages municipalities and local governments to apply for assistance to develop an EMS. EPA-funded program would provide monies for training and technical assistance to develop an EMS by a consultant (Dufresne 2000). In 1999 and 2000, the EPA sponsored 2 pilot programs with 14 organizations determine the benefit of an EMS on local governments (GETF 2001). The results strongly suggested that applying an EMS using the same guidelines of ISO 14001, helped participants to identify regulatory requirements as well as provided them the opportunity to work closely with regulatory agencies to identify potential compliance violations prior to an EPA regulatory audit. Participants repeatedly reported cost saving of thousands of dollars as a result of applying the program (GETF 2001).

There are several advantages to complying with ISO 14000 standards: ease of trade; improved compliance; credibility; reduction of liability and risk; improved efficiency; relieved pressure from stockholders and environmentalists; community goodwill; and better availability of insurance (Cascio 1996). Application of an EMS could reduce industrial emissions and provide better management practices which could in effect improve productivity and promote cost reduction. ISO 14001 guided Tytex, Inc. in decreasing electricity, gas, and water usage by 26%, 24% and 21% respectively. Their recyclable wastes rose almost 30%. Ford's Michigan truck facility reduced water consumption by almost 3.8 million L and saves almost \$66,000 a year by making electrical adjustments. They were able to recycle 17,000 tons of paint waste and reduce 73.8 million kg of disposable packaging (Fielding 2001).

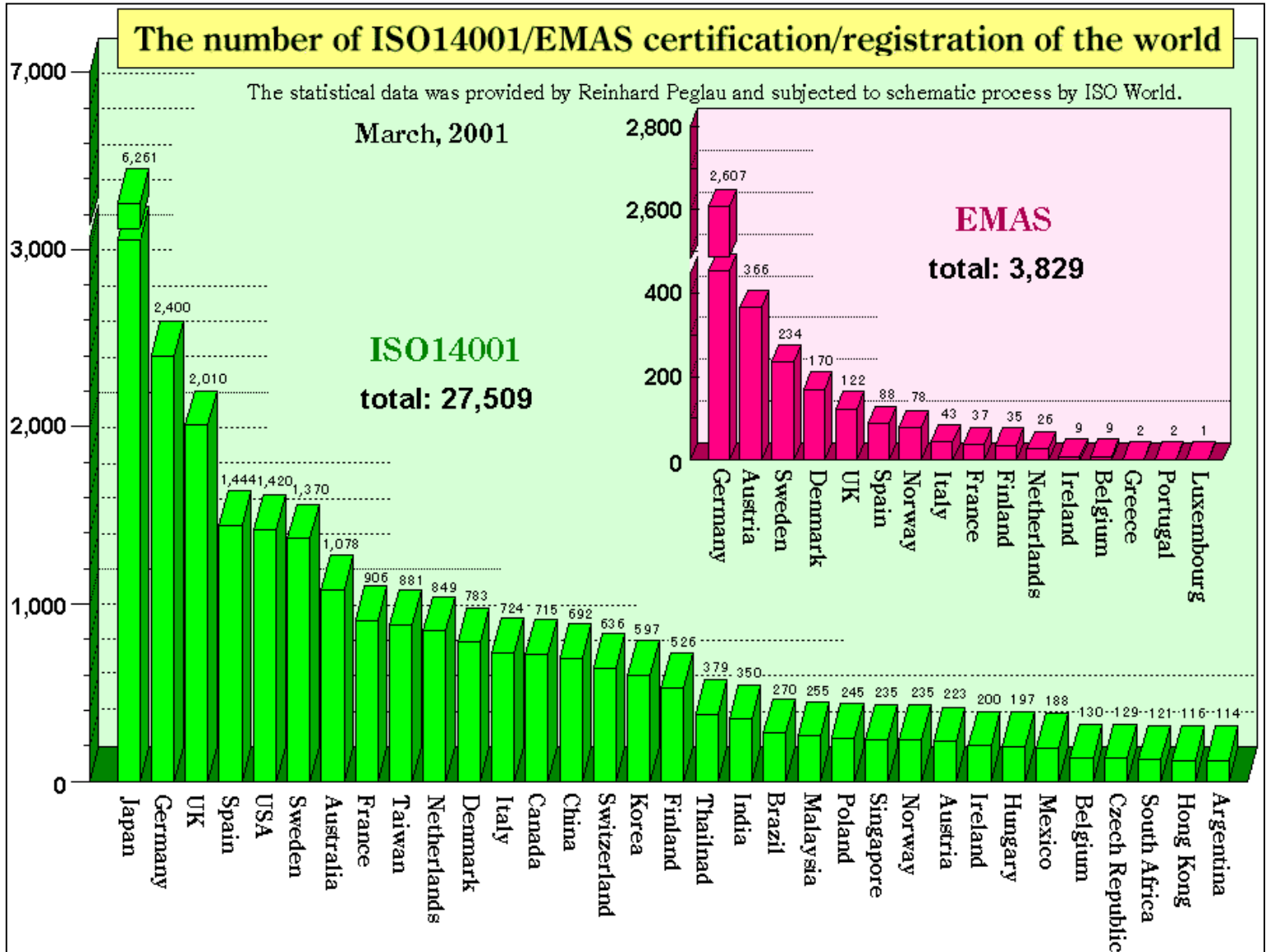


Figure 1. The number of ISO 14001/EMAS certification/registration of the world (ISO World 2001)

Ford Motor Company is requiring ISO 14001 certification from all of its suppliers with manufacturing facilities by July 1, 2003 (E-Wire 2000). Ford is requesting suppliers to certify at least 1 manufacturing site to ISO 14001 by the end of 2001. These requirements affect about 5,000 of Ford's production and non-production suppliers with manufacturing facilities. One such facility is Bosch Braking Systems. Bosch is a German-owned company that supplies the automobile and brake parts for a number of Ford vehicles. Bosch owns and operates nine manufacturing facilities in the United States along with two test facilities and two non-manufacturing headquarters (Bosch 2001). There are approximately 21,750 associates employed at Bosch's 50 North American locations. These facilities are currently undergoing structural and documentation changes to prepare for ISO 14001 certification. To obtain certification, a corporation must examine the processes within its operation and examine which processes produce significant impacts to the environment. Objectives and targets must then be set to minimize the impacts and to monitor progress. The final result is an ongoing process of continuous improvement.

Because ISO 14001 implementation will eventually affect every aspect of the Bosch industry, every employee must be made aware of the significant role he or she plays in environmental management. Whether it is energy conservation or waste reduction, employees will be made aware of the environmental efforts being made by their plants. The distribution of information to Bosch employees regarding ISO 14001 needs to be effective in reaching both production and non-production personnel. A clear understanding of ISO 14001 is needed for the EMS to function properly.

In addition to ISO 14000 information, if employees are well aware of how their particular processes affect the environment, they will be more apt to participate in protective

measures to reduce the impact. Training and communication between management and non-management is vital to assure that employees are well aware of environmental consequences that could result from a particular operation. Studies have shown that employee involvement translates into motivation and better performance (Corbett 1992). Manufacturing firms in Austria and New Zealand were evaluated to determine the effect distribution of knowledge had on industries. Studies showed that those companies who ensured training of the organization's goals throughout all staff (from top management to every worker) reaped benefits of better productivity and performance (Corbett 1992). One study used a questionnaire to examine quality awareness in relation to employee commitment to quality (O'Brien 1995). The results indicated that those processes best understood by employees were more likely to succeed and experience employee support participation (O'Brien 1995).

Understanding the factors associated with workers' cooperation with associate programs can contribute to ISO 14001's success. Research conducted by Glew (1995) maintained that employee participation is dependent upon a number of factors. These factors include awareness, job description, job satisfaction (morale), gender and management support. Glew stated that personal differences, such as "level of ability, preferences, attitudes and personally factors" could impact participation within an organization (1995). Programs initiated by management are well received by employees if employees feel involved in the process. Programs designed to increase the amount of information that employees receive about their organization, and that provides them with the opportunity to make decisions at workplace level, enhance their commitment to the employer (Marchington 1994). Employees with a cognitive understanding of the process and support of corporate goals are more likely to remain involved with employer's goals. The survey study performed by O'Brien also focused on employee commitment and

involvement. The results indicated that while a workforce may become involved with new processes or activities, commitment to quality or process improvement requires a higher level of personal commitment. Participation can be continued as a prior successful experience (1995). Results of another survey study performed by Miller (1992) indicated that younger, union-involved employees who had high job satisfaction were more likely to participate in employee involvement programs. Managerial personnel play a large role in employee support in that if supervisors do not stand behind the intended program, the program will not incur strong worker participation. Furthermore, “if supervisors actually embrace participation program that increases workers’ control, and if those workers likewise endorse the program, the program outcomes may be even greater than the organization had reason to expect” (Glew 1995). Hatcher, Ross, and Collin (1991) found a correlation between apathy and negative attitudes towards a plan, management and the company and the decision not to contribute suggestions. Glew adds that structural organizational decisions (decisions allowing individuals to contribute) strengthens participation and provides a basis for moral. Employer motives, commitment to the program, and values influence willingness to participate (Glew 1995).

Employee Surveys

Surveys are a useful tool in the workplace if designed and applied properly. Employee-attitude surveys have been used to evaluate morale, team-building efforts, and a host of other information (Fishel 1998). Attitude surveys are a means to measure the aggregate feeling of employees (Nogami 1996). Traditionally, employee attitudes have not been a matter of much concern to employers. However, employers have now found it to their benefit to identify employee attitudes towards job satisfaction, motivation, cooperation, turnover, and performance

(Lyne 1989). As organizations expand the role of employees and develop new programs, these factors have become paramount in cultivating opportunities for improvement throughout the workforce (Fishel 1998). With the number of companies adhering to ISO 14000 policies increasing, surveys can reveal needed insight on the intentions and priorities of corporations.

A number of ISO 14000 related surveys were conducted between 1994 and 1995 to determine interest in developing and implementing EMS initiatives and environmental auditing programs (Cascio 1996). While interest was strong in developing these initiatives, the companies surveyed had no intentions on being aggressive in ISO 14001 certification (Cascio 1996).

A survey of the 100 leading business analysts and decision makers in France, Germany, and the UK reveals that corporate social and environmental responsibility has changed from a “gesture of goodwill” to a matter of top priority and in some cases a mandate (ENN 2000). The survey focused on the attitudes and expectations of professionals regarding corporate and social responsibility to protect the environment. Some of the findings are as follows:

- 1) Corporate social and environmental responsibility must be dealt with as an integrated part of business planning
- 2) A company's performance and impact count globally as well as locally
- 3) Exemplary environmental performance is regarded as a minimum requirement when assessing a company, and more attention to softer human relations is also being demanded
- 4) Charitable giving by companies, while still commendable, is not important enough on its own. Unless good environmental stewardship is in place, charitable giving is viewed with suspicion (ENN 2000).

Additional surveys conducted by Apple Computer's Environmental Health and Safety Division, Arthur D. Little Inc., and Dun and Bradstreet, revealed a strategy of reasoning behind ISO14000/14001 registration. The results from their surveys indicated that the majority of U.S. companies wanted to learn more about what their customers were demanding, what their competitors were doing, and the trend in the foreign market place prior to pursuing certification (Cascio 1996).

The usefulness of employee attitude surveys has been supported by numerous studies completed by both the public and private sector. At least a quarter of the articles published by the Cornell Quarterly have been based upon survey results (Paxson 1995). Organizations spend millions of dollars every year attempting to gather information from employees using questionnaires (Chaudron 1997). Survey results frequently headline industry publications and are the basis of topics of interest of conferences and workshops (Burzawa 1996). Questionnaires are useful when there is reason to believe that employee attitudes are different from those that management would prefer are valuable in displaying differences between perceptions in establishments by placing employees' attitudes in the perspective of the entire organization (Rothwell 1983). Results provide information for personal policies and practices and can help to assess training needs, predict turnover, and evaluate the overall effectiveness of the organization's personnel program (Rothwell 1983). A well-designed survey will help to evaluate current conditions and can serve as a stimulant to management by revealing misconceptions of employees and demonstrate just how differently people can interpret management actions (Rothwell 1983).

Credible surveys require skills and resources for design, testing, analysis, and reporting (Cain 1983). A survey project, from conceptualization to interpretation and reporting, will take a

certain amount of time (Nogami 1996). The more time spent in survey design and development, the less time will be spent in data analysis and interpretation (Nogami 1996). Quality survey design consists of careful wording and specific questions. By making a question specific, the information gathering process becomes more focused (Nogami 1996). Research must be performed on the subjects to determine reading level and accessibility to survey distribution. Fink (1998) suggests the following techniques for designing survey questions: use complete sentences, avoid abbreviations, use shorter questions to minimize reading, and have questions reviewed by experts and potential respondents. How a question is asked affects what will be attained from a survey. There are three categories of questions. They are attitude questions, knowledge questions, and behavior questions. Attitude questions gather information on attitudes and are generally concerned with how the participant feels or thinks about something. Knowledge questions are asked to determine whether the person knows the specifics about a product or service. Information on behavior can be obtained through behavior questions (Nogami 1996). Behavior and knowledge type questions are worded differently to get a desired effect. For example, attitude questions are worded as follows: “how do you like/feel about...”, knowledge questions “does your company recycle paper (yes/no)” and behavior questions use phrases such as “how often or when” (Nogami 1996). Although developing specific unbiased surveys is very time consuming on the front end, it will result in data that are easier to analyze and interpret upon completion (Nogami 1996).

Errors occur in surveys at 2 points: sample design and sample methods/operations. Control of sampling error and non-sampling error add to establishing the quality of the survey (Chaudron 1997). Sampling error can be due to nonrandom distribution of the survey or through sample design. Random distribution is vital if views are to represent all portions of the

population to be examined. Assael (1982) discusses non-sampling and sampling errors in survey research (1982). Fink (1998) and Rea (1992) both have written numerous articles and books describing survey reliability, validity, and quality. Quality and survey reliability (ability to measure what is being questioned) are examined before survey distribution and survey credibility (accuracy of information) is established when the time comes to examine survey results. The information produced as a result of the survey analysis can be of use only if applied to improve current conditions. Professionals who conduct surveys and neglect to use the data are wasting valuable time and information. Communicators should make sure that the surveys conducted will be used as strategic instruments to improve the organization and impact the bottom line (Geddie 1996).

My thesis project includes a survey study of four plants owned and operated by Bosch. Upon receipt of the surveys a thorough analysis of the data was performed to examine employees' familiarity with the ISO 14000/14001 system. The data received from this study will be used to improve ISO 14000/14001 training efforts across the Bosch locations and perhaps identify weaknesses within the current training system.

CHAPTER 3
METHODOLOGY

Survey Design

The questionnaire was constructed to measure opinions about many environmental attributes and seeks to answer the following questions:

- 1) Is ISO 14001 perceived as a viable asset to Bosch employees in Ohio, Indiana, Tennessee, and South Carolina?
- 2) Is there is a statistically significant difference between job title and perception of implementation of ISO 14001 at the 4 Bosch locations?
- 3) Is there a statistically significant difference in the employees' knowledge and understanding of environmental management systems between Bosch plants?
- 4) Is there a statistically significant difference of employee support of a company operated waste reduction program when there are economic benefits offered as opposed to no benefits?

Question topics ranged from ISO 14000 to personal environmental responsibility. Six of the questions were adopted from a survey issued by the ISO website (ISO 2001). The 6 questions investigated of plant specific conditions and were chosen because of the their potential to provide valuable data useable by each locality. Wording of survey questions was adjusted to be sensitive to that portion of the worker population having low reading skills. Survey readability was measured against the Ki-A reading scale (provided in MS Word) and was determined to fall within the 7th grade range. Readability difficulty increased with the specificity of wording necessary to the focus of the study (i.e. environment, management, and ISO 14001). The survey was reviewed by committee members and by an expert statistician (conversations

with Dr. Harvill in 2001, see Acknowledgements) for completeness. Conversations with noted professionals (East Tennessee State Environmental Health Department faculty in 2001, see Acknowledgements) provided guidance with survey reliability, sample size, and design. A pilot test was conducted at each plant to determine the functionality and effectiveness of the questionnaire. Adjustments made following the pilot survey included rewording, specific directions, and additional instructions as headers and footers. After format and wording revisions, surveys were mailed for distribution. The final draft resulted in a 2-page, 23-question document (Appendix A). The majority of the questions were categorical, one was dichotomous, and one was ordinal. Announcements pertaining to the survey were sent to each plant for posting in high traffic areas 3 weeks prior to survey distribution to increase response rate.

Sample Size

Nine hundred sixty-six Bosch Braking Systems employees from 4 plants were randomly selected for the study. This was accomplished by the generation of a random number table in Excel and locating the corresponding number on a list containing the names of the employees for each plant. The employees were selected from 4 North American plants: Johnson City (TN), South Bend (IN), Sumter (SC), and Ashland (OH). These plants were chosen based upon the similarity of their operations (brake manufacturing plants) and willingness of contact personnel to participate. Plant demographics are found in Table 1. Subjects varied by occupational duties and position. The Johnson City, Sumter, and Ashland plants all had process operations requiring the skills of production and non-production personnel. Therefore, these 3 plants underwent random, stratified sampling of all associates. The South Bend facility was comprised of non-production personnel only (administrative and engineering services), deviating from the

previously described conditions. Selection of this plant was based on the fact that the other plants contained a disproportionately large production population. Moreover, South Bend provided a sizeable population of non-production associates and, therefore, presented a unique opportunity to assess respondents from broad job categories. The formula used to determine sample size is as follows (Scheaffer 1996):

$$n = \frac{Npq}{(N-1)\frac{\beta^2}{4} + pq}$$

$p =$ proportion of workers (0.5) $q = 1-p$
 $\beta =$ margin of error (0.05)
 $N =$ number of associates

$$n = \frac{\text{total number of production associates} * 0.5 * 0.05}{(\text{total number of production associates} - 1) * (0.0025/4) + 0.25}$$

(Repeat for non-production associates)

The self-administered questionnaires were sent to HSE (Health, Safety, and Environmental) liaisons at each plant. Correspondence was maintained with one contact person per plant. This person, after receiving verbal and written instructions from the author, delivered the questionnaires (and accompanying cover letters) (Appendix B) to the assigned subjects. In addition, the assigned person was responsible for collecting and returning the completed surveys. Survey distribution in Johnson City and Ashland was restricted to a single building because of the relatively small employee population. Because of this factor, the majority of the surveys could be hand delivered to the staff. This proved to be rather difficult for South Bend and Sumter because of the facilities' layout. Both plants had operations in 2 separate buildings. For these highly populated facilities, many of the surveys had to be distributed through interoffice mail. Respondents were provided with an incentive for survey completion in the form of a Bosch baseball cap. Survey distribution and response rate is given in Table 2.

Returned surveys were examined for completeness and consistency. Responses were discarded if found to be incomplete or noncompliant with instructions. The data were entered into a Microsoft Excel spreadsheet and then edited for completeness. Data were coded and transferred into a Mini tab (Johnson City, TN) system. Data worksheets were reviewed for quality control measures and frequency distributions of responses were computed and sorted in tabular form. The null hypotheses were tested using Chi-square statistical analysis with a significance level of 0.05.

Table 1. Plant demographics

	Sumter	Johnson City	Ashland	South Bend
Total population	903	368	226	550
Non-production	132	50	36	550
Production	771	318	190	0
Percentage of male and female employees sampled	M- 39 F- 61	M- 88 F- 12	M- 83 F- 17	M- 25 F- 75

Table 2. Survey distribution

	Sumter			Johnson City			Ashland			South Bend
	N	P		N	P		N	P		
Associates to sample	363 <i>total</i>	100	263	227 <i>total</i>	50	177	144 <i>total</i>	33	111	232 <i>total</i>
Expected return (50%)	181			113			81			116
Surveys returned	200			134			69			155
Response rate %	55			59			47			67

N- Non-Production associates

P-Production associates

CHAPTER 4

RESULTS AND DISCUSSION

Seven hundred twenty-six 726 surveys were distributed to 4 Bosch locations. Of the 726, 558 (77%) were returned. Out of the 100% returned surveys, 24% were from Johnson City. Twelve percent were from Ashland. Thirty-six percent were received from Sumter and 28% from South Bend. The sample distribution of responses is given in Table 3. Of 558 respondents, 185 were female (33%) and 370 were male (66%). One percent did not provide gender data. In addition to responses given to survey questions, several employees provided comments and suggestions in their surveys. Responses were obtained from all positions and salary assignments.

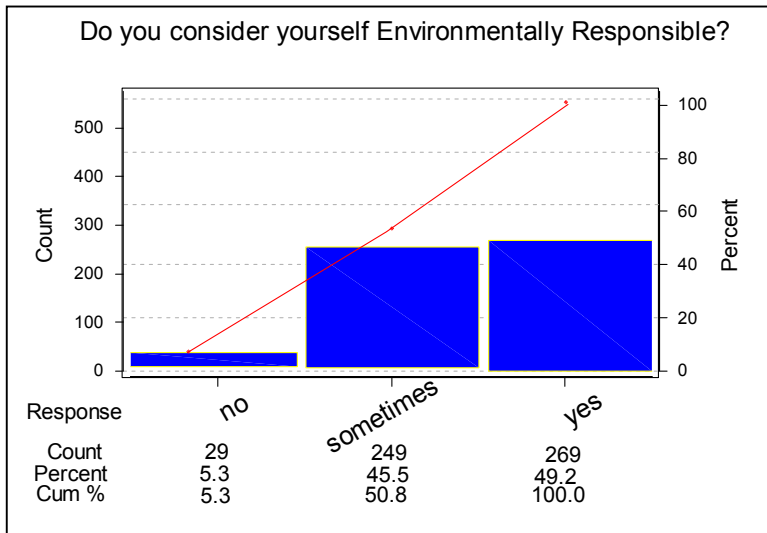
Table 3. Surveys received per location and gender

Location	Respondents of 100% received	Male	Female	Comments/suggestions received*
Johnson City	24% (134)	90% (120)	10% (14)	5
Ashland	12% (69)	83% (57)	17% (12)	5
Sumter	36 % (200)	39% (77)	61% (120)	19
South Bend	28% (155)	75% (116)	25% (39)	19

* Comments and suggestions are displayed in Appendix C

Bosch associates responded positively to the general questions concerning environmental management (both personal and plant sponsored). The majority of respondents consider themselves as environmentally responsible and support recycling efforts at their respective locations (Figure 2). Item 14 on the survey asked if employees felt it was important for their business to display a “good environmental image”. An overwhelming 96 % Bosch employees responded “yes”. Ninety-five percent of all associates said that maintaining an environmentally friendly business was possible. When asked if employees believed that it is a business’s financial duty to be environmentally responsible if its products or processes impacted the environment, 95 % of all employees surveyed answered “yes”. Item 17 asked employees to mark the dollar limit they felt should be spent by a company annually to reduce waste and pursue environmental excellence. Forty-one percent marked “don’t know” or “don’t care”. Forty-four percent marked “greater than \$10,000”. Fourteen percent said “less than \$10,000” and only 2 % of all respondents said “none”.

Although Bosch employees generally perceived the environment as an important issue, it ranked third in comparison to medical care, quality education, safe drinking water, and standard of living. Figure 3 demonstrates how associates rank environmental protection in relation to other socioeconomic concerns. The graph implies that personal health issues were valued over education, environmental protection, and standard of living.



The bars in the diagram signify the counts per response. The red line is representative of the cumulative percentage of tallied responses.

Figure 2. Respondents who consider themselves to be environmentally responsible

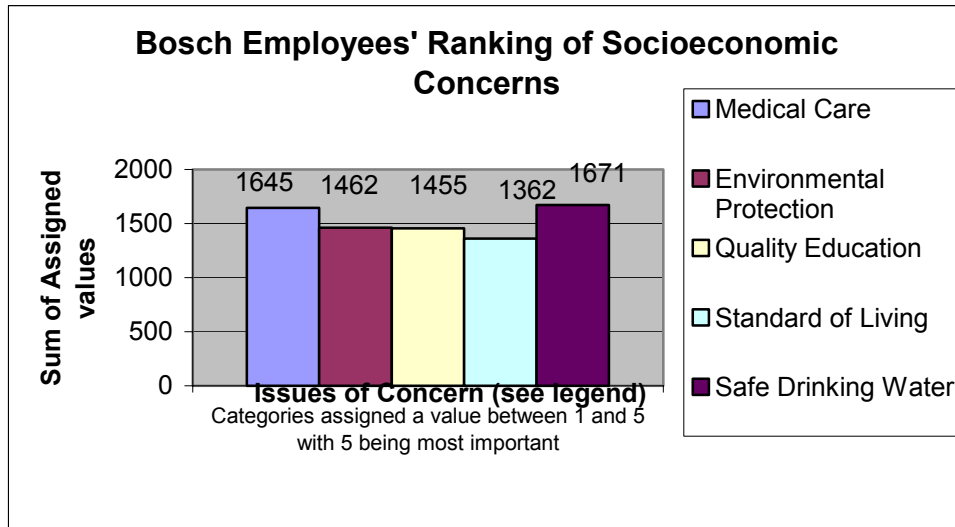


Figure 3. Bosch employees' ranking of socioeconomic concerns

The questionnaire was designed to measure a variety of attributes. The focus of the study was to examine associate awareness and opinion of an environmental management system and to test 4 hypotheses:

Hypothesis 1: ISO 14000 is perceived as a viable asset to Bosch employees in Ohio, Indiana, Tennessee, and South Carolina.

Item 7 on the survey was used to measure this hypothesis. If more than 50 % of the employee population responded that ISO 14000 was helpful to the company and environment, then it can be concluded that employees see it as a valuable asset. However, employees were first asked to answer questions regarding ISO 14000 awareness. When questioned, 19 % claimed to be familiar and 28 % described themselves as “somewhat” familiar with ISO 14000. Fifty-two percent of all employees said they were not familiar with ISO 14000. Only 12 % said they were clear about the benefits and 29 % claimed to be somewhat clear about the benefits. Fifty-nine percent of all employees surveyed stated they were not clear about ISO 14000’s benefits.

Item 7 asked employees to give their opinion of ISO 14000. Twenty-nine percent of all employees said that ISO 14000 was helpful to the company and the environment. Thirteen percent said it was helpful to the safety of employees. Fifty-seven percent of employees did not know. Only 0.5 % said it was useless (Table 4). Because the majority of Bosch associates were unfamiliar with ISO 14000 and responded “did not know” for item 7, the hypothesis is untestable. The findings revealed that at the time of the survey, the majority of Bosch associates did not know enough about ISO 14000 to determine whether or not it is an asset or not to the facility.

Table 4. Employee opinion of ISO 14000

Opinion of ISO 14000	Count	Percent
Don't know	317	57
Helpful to Environment and Company	161	29
Helpful to Employee Safety	72	13
Useless	3	0.54
Left blank	5	0.46
	558	100%

When analyzing results, respondents were asked to omit item 7 if they were unfamiliar with ISO 14000. Questionnaires with omitted responses were pooled with the "Don't Know" responses. More than 50% of all respondents claimed to have no knowledge or familiarity of ISO 14000 at the time of the survey.

Hypothesis 2: There is no statistically significant difference between job title and perception of implementation of ISO 14000 at the 4 Bosch locations.

Item 3 on the survey asked employees to give their payment assignment and item 4 asked subjects to give their position in their plant. Fifty-five percent identified themselves as hourly. Almost half of the employees surveyed were non-production employees (Figure 4). When comparing the answers given for item 4 (position) and item 7 (opinion of ISO 14000), it was determined that upper management and Health, Safety, and Environment (HSE) employees were proportionately more likely to perceive ISO 14000 as beneficial to the plant and environment as opposed to the remaining positions (Figure 5).

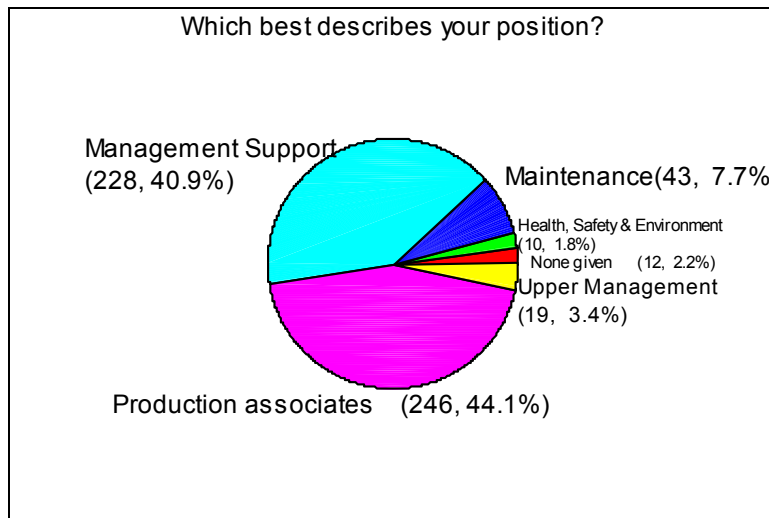


Figure 4. Respondents per job title

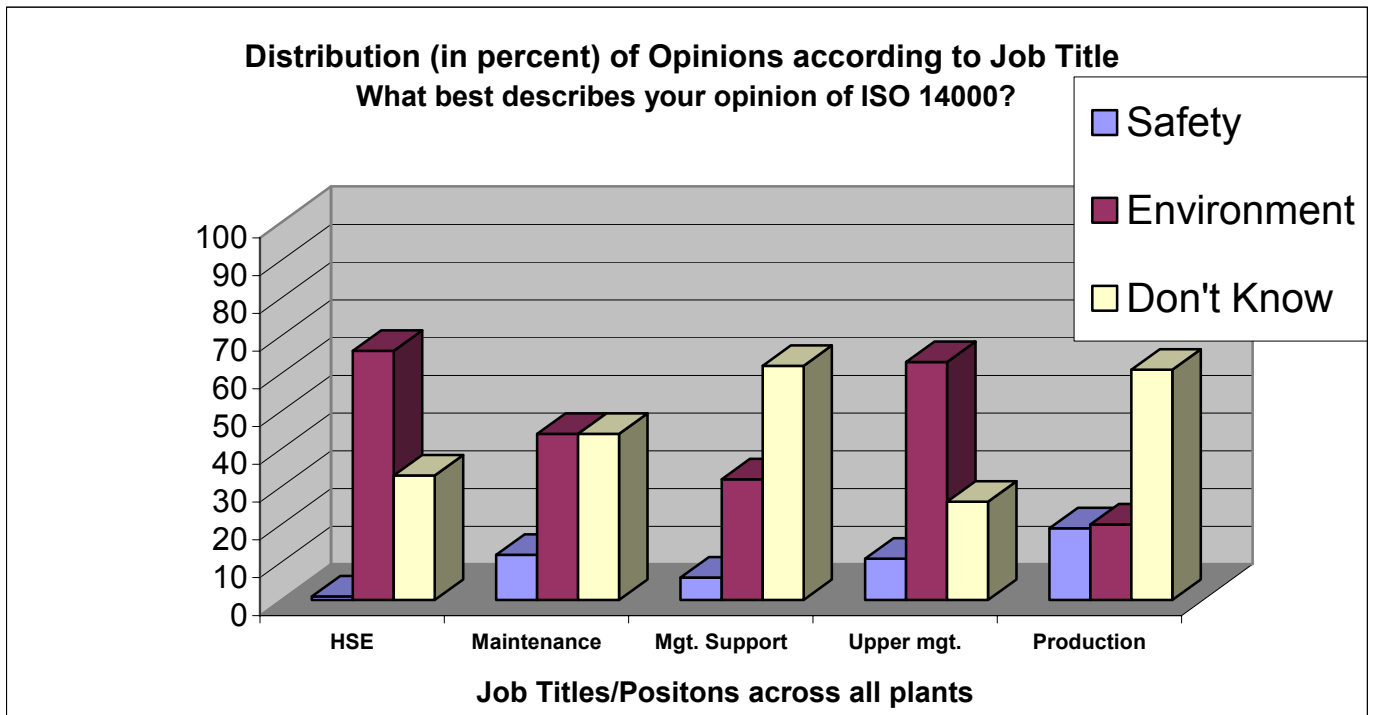


Figure 5. Job title and opinion of ISO 14000

The analysis comparing item 4 with item 7 examined 550 responses because 8 subjects either did not respond or gave answers in categories too small to be measured. When observing responses, it was determined that 66 % of HSE employees and 63 % of upper management knew ISO 14000 concerned the environment. Responses for maintenance, management support, and production are 44 %, 32 %, and 20 % respectively. Using Chi-square, it was determined that there is a statistically significant difference between job title and perception of implementation of ISO 14000 (Chi-Square 54.289, DF = 10, P-Value < 0.001). The null hypothesis is rejected.

Hypothesis 3: There is no statistically significant difference in the employees' knowledge and understanding of environmental management systems between Bosch plants.

Item 2 asked employees to give their facility location. Response distribution is displayed in Figure 6. Items 5 and 6 asked associates about their familiarity with ISO 14000 as well as their clarity of the benefits of applying the system to their plants.

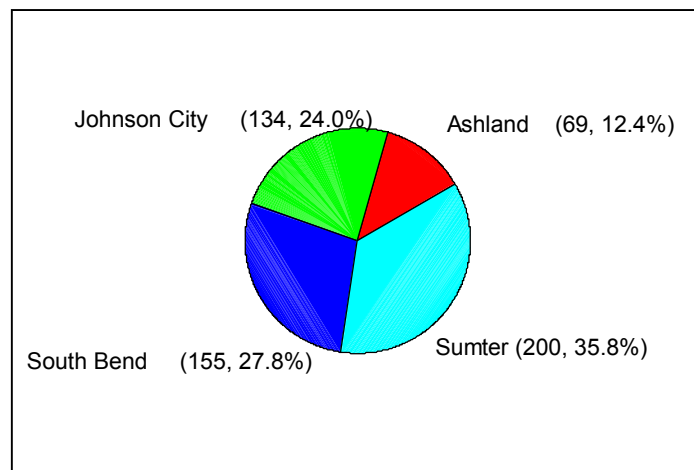


Figure 6. Responses received per location

When comparing answers between the 4 plants, it was found that Ashland and Johnson City had the highest percentage per plant of employees who said they were familiar with ISO 14000 (23% at each plant). Figures 7-11 demonstrate the distribution of associate answers per location. There is a statistically significance difference in ISO 14000 knowledge/familiarity between plants based on Chi-square analysis with a 95% confidence. The null hypothesis is rejected.

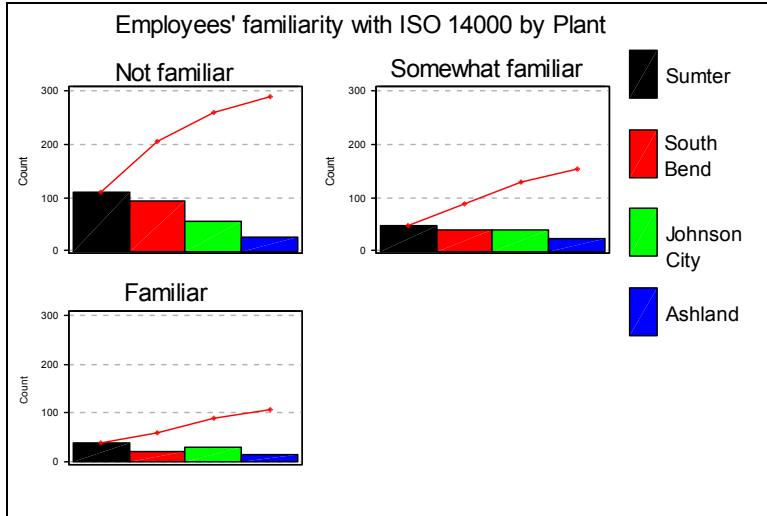


Figure 7 demonstrates the total number of responses given for each plant in regards to familiarity of ISO 14000. Plants are represented with color coding. The red line signifies cumulative response.

Figure 7. Familiarity with ISO 14000 for all locations

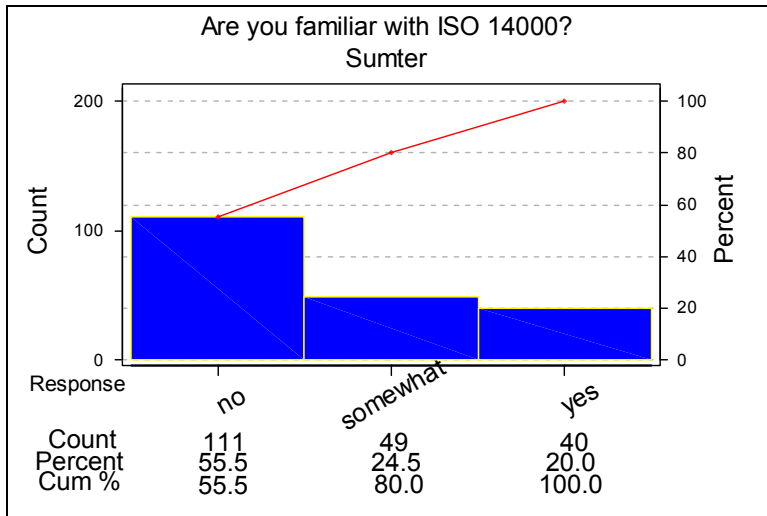


Figure 8. Employees' familiarity with ISO 14000 (Sumter)

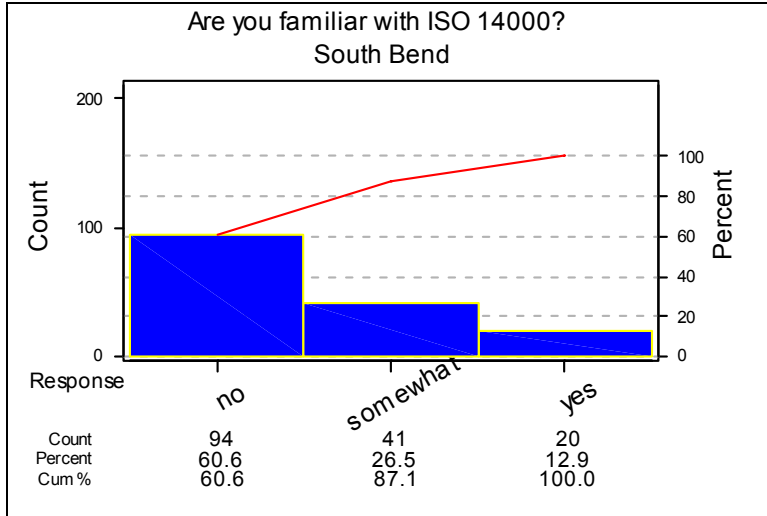


Figure 9. Employees' familiarity with ISO 14000 (South Bend)

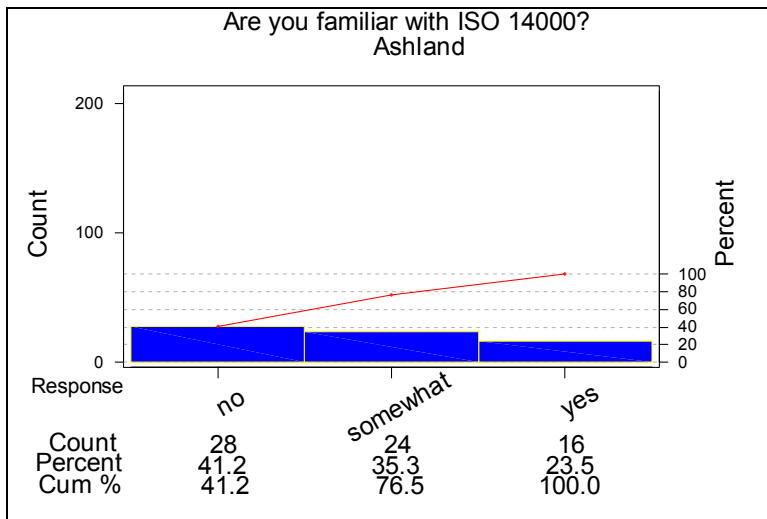


Figure 10. Employees' familiarity with ISO 14000 (Ashland)

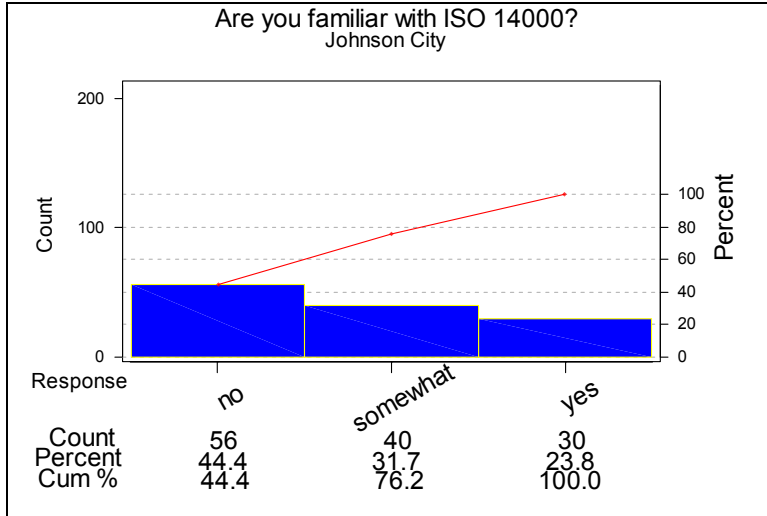


Figure 11. Employees' familiarity with ISO 14000 (Johnson City)

Upon statistically comparing answers given for familiarity with ISO 14000 to location of respondents, a statistically significant difference was identified. The Chi-square value was 13.721 with 6 degrees of freedom. The P-value was measured at 0.033. Therefore the null hypothesis was rejected.

Hypothesis 4: There is no statistically significant difference in employee support of a company operated waste reduction program when there are economic benefits offered as opposed to no benefits.

Although the majority of Bosch employees agreed that the environment was an issue of high concern, support of a waste reduction program was highly dependant upon economic factors. Item 16 of the questionnaire presented a series of circumstances and asked employees to respond “yes” or “no” to their support of a waste reduction program as it applied to the various conditions. Figures 12-15 present in graphical form the tremendous differences in support offered depending upon economic benefits or lack thereof. The null hypothesis was rejected based upon the contrasting responses (as seen in the following diagrams) and Chi-square analysis of responses.

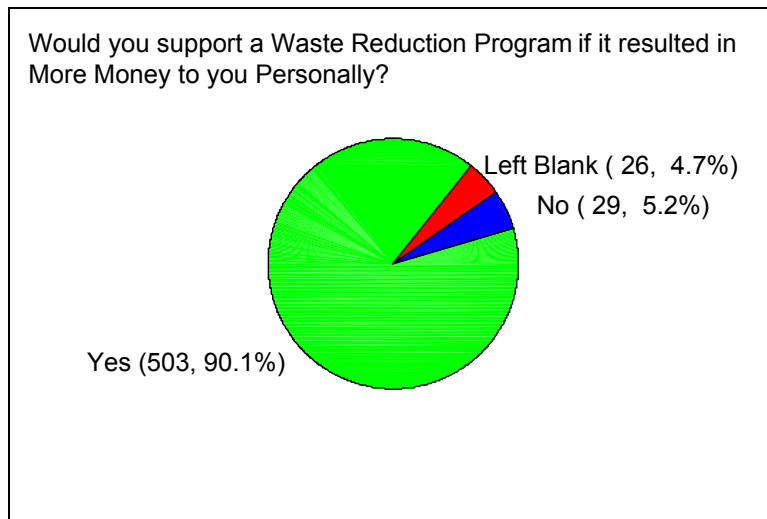


Figure 12. Employees’ support of waste reduction program when employees benefit

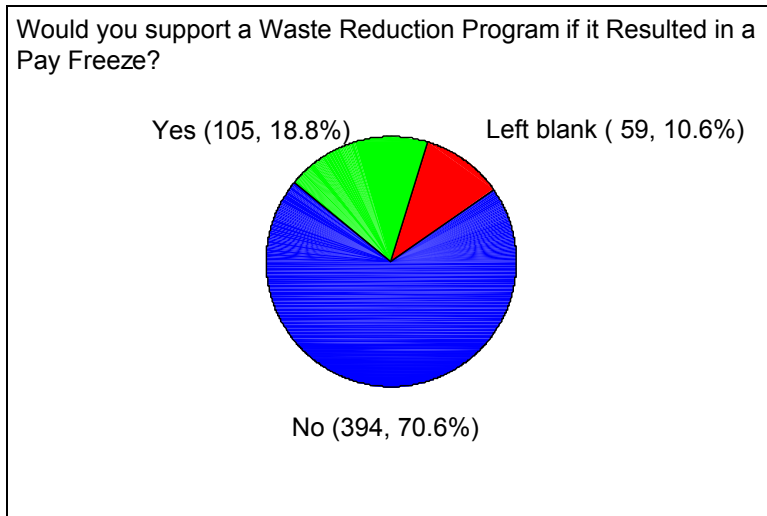


Figure 13. Employees' support of waste reduction program resulting in pay freeze

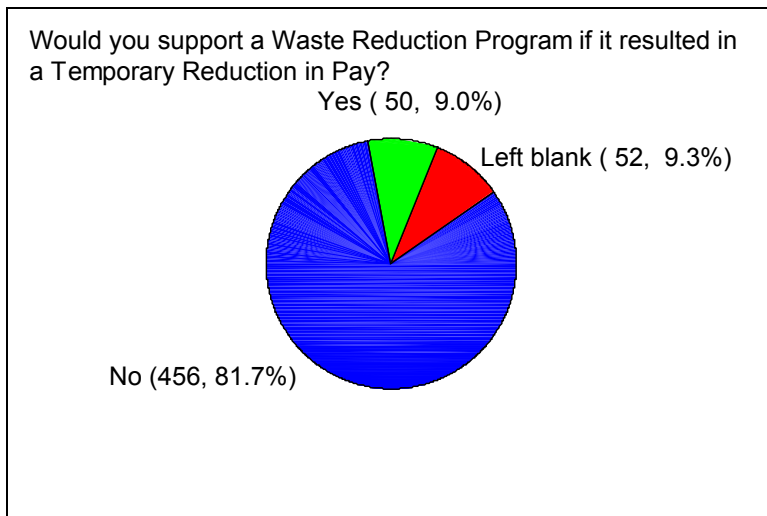


Figure 14. Employees' support of waste reduction program resulting in temporary reduction in pay

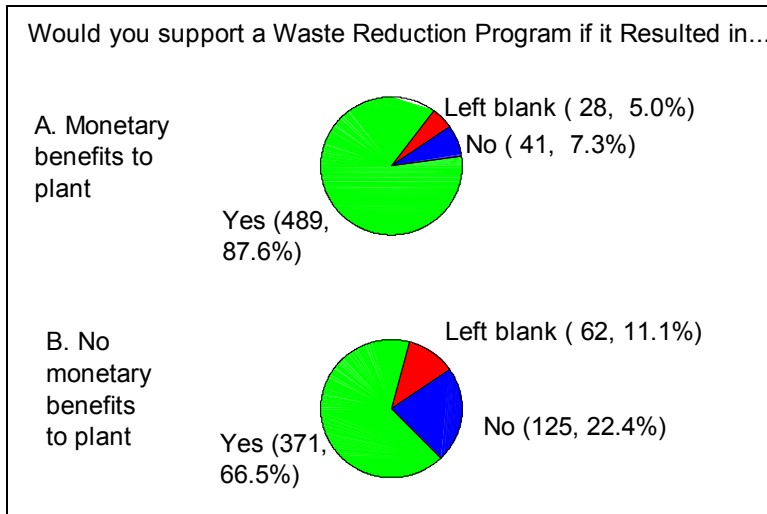


Figure 15. Employees' support of waste reduction program when plant is affected

Comparing Figures 12,13, and 14, it is evident that employees are in support of plant operated waste reduction when they benefit from the program but not when it could result in a pay freeze or pay reduction. According to the employee responses, even less favor is shown in the case of a reduction in employee pay. However, when examining responses when the facility itself is affected (assuming no effect on employee salary), support seems to be positive. There is an even smaller amount of support when the plant does not benefit. When applying Chi-square to the results in Figures 12 and 13, there was a significant difference with a P-value less than 0.001. When comparing results illustrated in Figure 15 A with Figure 15 B there was a 21.1 percentage points difference of support of the waste program.

In addition to measuring the 4 stated hypotheses, the author gathered descriptive data using questions similar to those posted on the ISO 14000 website (ISO 2001). The final 6 questions of the survey were adopted from the site and results are presented in Appendix D.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

Summary

The purpose of this study was to determine Bosch employees' awareness in North American plants (Johnson City, TN; Sumter, South Carolina; Ashland, Ohio; and South Bend, Indiana) of ISO 14000 (an environmental management system). A 23-question survey was used to collect data, and Chi-square analyses were performed to measure statistical differences in opinion. The hypotheses examined are as follows:

1) Is ISO 14000 perceived as a viable asset to Bosch employees in Ohio, Indiana, Tennessee, and South Carolina?

There is a limited awareness of ISO 14000 among Bosch associates. Apparently at the time of the survey, Bosch's general ISO 14000 awareness sessions were not successful in familiarizing employees with the environmental management system. Another reason for the lack of ISO 14000 awareness could be the newness of the program. Although Ford had announced its decision of ISO 14001 certification for suppliers approximately a year prior to the survey, however, during the period of survey distribution, information concerning ISO 14000 had not been distributed to all employees. Employee awareness is a requirement for a company to become ISO 14001 certified. Fortunately, since the time of the survey, more efforts have been made to increase training and education of employees about ISO 14000 and its benefits. If employees are aware of its benefits (waste reduction, cost savings, environmental protection)

they will be more likely to support the system. At the time of the study, lack of familiarity with ISO 14000 prevented Hypothesis 1 from being tested.

2) Is there is a statistically significant difference between job title and perception of implementation of ISO 14000 at the 4 northeastern Bosch locations?

The 2nd hypothesis examined the difference of perception of ISO 14000 among job titles. The associates were asked their opinion of how ISO 14000 would affect their facility. Although the environmental management system has nothing to do with safety, a number of production employees indicated that ISO 14000 would improve employee safety. Upper management and HSE employees indicated a more accurate concept of how ISO 14000 would affect operations. Chi-square results showed a statistically significant difference in employee perceptions per job title. Perhaps HSE and Upper management have the more accurate perception because more knowledge and information has been made available to them. It is imperative that all employees (regardless of position) be knowledgeable about what an environmental management system is. Many may see it relating to safety because the persons responsible for safety at the plants are the same persons responsible for stressing EMS awareness. Furthermore, production employees may not be aware of how their jobs impact the environment. They may see an Environmental Management System as something only applicable to Upper Management or HSE although it applies to every department. More emphasis needs to be placed on the environmental principle of the system.

3) Is there a statistically significant difference in the employees' knowledge and understanding of environmental management systems between Bosch plants?

When comparing associate awareness of ISO 14000 between plants (Hypothesis 2), it is suggested that the awareness of ISO 14000 is the same at each plant. The Johnson City and Ashland plants had the highest percentage of employees who claimed familiarity with ISO 14000 (23%) and there was a statistically significant difference among the 4 plants. This aptly reflects the fact that although the system has just recently been implemented throughout Bosch, each plant is at different stages of the registration process.

4) Is there a statistically significant difference of employee support of a company operated waste reduction program when there are economic benefits offered as opposed to no benefits?

The 4th and final hypothesis concerned employee support in terms of financial ramifications. There was an overwhelming amount of support of a plant operated waste reduction program when the employee or plant benefited. However, there was almost complete opposition when employees stood the chance of losing pay or faced the possibility of a temporary pay decrease. Therefore, the hypothesis was rejected. Monetary consequences play a large role in the support offered to a company operated waste reduction program.

Conclusions

Although the overall surveyed population seemed to be in favor of environmental management (recycling, waste reduction), very few employees reported being knowledgeable of the fact that Bosch as a whole is implementing an environmental management system. If Bosch associates were given more EMS training and workshops, perhaps they would have a greater

understanding of how ISO 14000 can have a positive effect on their job and on the surrounding environment. Items such as flyers, handouts, or brochures could prove effective in distributing ISO 14000 information. Because of low reading skills among some of the production personnel, information could be better distributed by speaking with employees one on one rather than through written information. This would also give employees a chance to verbalize suggestions or concerns they may have about current environmental operations. Apparently, as noted in some of the suggestions, there was a feeling of disconnect between management and non-management. As a temporary Bosch employee, I was able to communicate some ISO 14000 benefits to employees at the Johnson City plant. The information was well received, and some production associates were seen relaying accurate ISO 14000 information to other employees.

The survey revealed that the majority of employees agreed that classroom training would be most effective at their plants as opposed to computer based, Internet, or videotape training. This information, if applied, can be put to use in future training sessions.

Biases

1. At the time of the survey, at least 2 of the Bosch plants were experiencing layoffs among production employees. This could have an effect on morale and employee response.
2. The presence of the author at the Johnson City Plant could have biased employee response rate because employees were familiar with who the author is and may have put forth a greater effort to complete and return surveys.

3. The fact that the plants included in this study were still within the early stages of certification does not reflect employee awareness or support after the results of this study were written.

Recommendations

1. More ISO 14000 related information and classroom training is needed. All areas of the Bosch workforce should be familiar with ISO 14000 and understand that it is an environmental management system that could positively reduce wastes and promote cost savings.
2. Greater efforts should be made to speak with non-management and production employees so that they have an accurate awareness of what the system is. Non-HSE personnel should become more involved with the training of employees so that trainees will not be under the impression that it is an employee “safety” program.
3. Additional surveys comparing employees’ perceptions and opinions should be performed post ISO 14001 certification. Bosch plants that have acquired ISO 14001 status should, in effect, have a more knowledgeable employee workforce in regards to the environmental management system. Applying another survey in the future could help to demonstrate if there is a measurable difference in employee awareness of ISO 14000 after certification.
4. Suggestions provided by Bosch associates need to be taken into consideration by management personnel when addressing environmental concerns. Employees seem to have strong opinions towards environmental issues. If their comments are acted

upon, employees will feel as if they have a stake in the program and will be more likely to support future improvement programs.

5. Additional comparisons should be done to see if the differences between plants are the result of regional, cultural, or gender differences among employees. Some plants have a much larger female to male ratio, and this difference could be investigated for training purposes.
6. Efforts should be made to determine employees' awareness of environmentally related health effects. Because they demonstrated a value for health concerns (medical care, safe drinking water) they may offer personal support of ISO 14000 with the understanding of its long term benefits on environmental and personal health.

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Chose only one answer

Please check one box

1. Are you male or female?
 M F
2. At which location do you work?
 Johnson City South Bend
 Sumter Ashland
3. Are you: salary nonexempt
 hourly
4. Which best describes your position?
 Upper Management
 Production/assembly
 Health & Safety Env Maintenance
 Management support (engineering, finance, quality)
5. Are you familiar with ISO 14001?
(if no skip to 8)
 yes somewhat no
6. Are you clear about the benefits as a result of applying ISO 14000 at your plant?
 yes somewhat no
7. Which of the following best describes your opinion of ISO 14001?
 Helpful to the company and the environment
 Helpful to the safety of employees
 Useless
 Don't know don't care

Please answer both sides

APPENDIX A - QUESTIONNAIRE

8. Do you regard yourself as environmentally responsible?
(i.e. purchase recycled products, recycle motor oil, active in waste reduction, recycle cans, etc.)
 yes sometimes no
9. Do you support recycling efforts at your location?
 yes sometimes no
10. Would you consider environmental awareness as being an issue of high main concern?
 yes no
 don't know don't care
11. Rank the following in order of importance with 1 being least important and 5 being most important
quality medical care____
environmental protection____
quality education____
standard of living____
safe drinking water_____
12. Do you feel maintaining an environmentally friendly business is possible? yes no

please answer both sides

Chose only one answer

13. Do you believe it is a business' s financial duty to be environmentally responsible if its products or processes impact the environment?
 yes no
 don't know don't care
14. Do you feel that it is important for your business to display a good environmental image?
 yes no
 don't know don't care
15. Do you feel ISO 14001 will improve your business's environmental image?
 yes no
 don't know don't care
16. *Please check " yes or no" for **all that apply**.*
I would you support a waste reduction program at your plant if it resulted in:

	Yes	No
More money to you personally	<input type="checkbox"/>	<input type="checkbox"/>
More money for the plant	<input type="checkbox"/>	<input type="checkbox"/>
Did not result in more money for the plant	<input type="checkbox"/>	<input type="checkbox"/>
Salary freeze in pay raises	<input type="checkbox"/>	<input type="checkbox"/>
A temporary reduction in pay	<input type="checkbox"/>	<input type="checkbox"/>

Thank you!

Chose only one answer

- 17. What do you feel is the dollar limit on how much a company should spend per year in order to reduce waste and pursue environmental excellence?
 - greater than \$10,000
 - less than \$10,000 none
 - don't know don't care

- 18. Which type of training would be most effective for you at your plant?
 - live classroom instruction
 - computer based training
 - Internet or Intranet training
 - Videotape training

- 19. Which type of environmental practice could be most improved at your plant?
 - Environmental Management Systems
 - Chemical or other waste generation and/or emission
 - Natural Resources Use
 - Other area not mentioned above
 - Nothing to improve
 - Don't know

Chose only one answer

- 20. Which area of environmental management could be most improved at your company?
 - Auditing, checking, corrective action
 - Keeping up to date with changing requirements
 - Measuring environmental performance
 - Record keeping and/or reporting
 - Training (Delivery, Effectiveness, Tracking)
 - Don't know

- 21. What role is most important for outside ISO 14001 consulting at your site?
 - Gap analysis, audits, assessment
 - EMS development and/or implementation
 - Training
 - Other
 - Do not have any role for outside help
 - Don't know

Chose only one answer

- 22. While pursuing certification to the ISO 14001 standard, what do you see as your major obstacle?
 - Lack of management support
 - Combining the standard with the current system
 - Not enough resources to develop an EMS
 - The cost of certification and maintaining an EMS
 - Don't know

- 23. In pursuing ISO 14001 registration, which most influenced your decision?
 - Pressure from customers
 - Request from senior management
 - To gain advantage over competition
 - Desire to simplify environmental efforts
 - Don't know

Thank you for participating

If you have suggestions on how your plant can reduce waste please write below:

Please answer both sides

Please answer both sides

Thank you!

APPENDIX B
INFORMATIVE LETTER

Dear Bosch Associate,

March 23, 2001

My name is Charlette Clark and I am studying environmental health at East Tennessee State University. In taking the time to complete the following survey, you will be helping to identify the needs of your plant and helping to gather information about the views and opinions of Bosch employees on environmental management. The survey takes 5 minutes to complete and your identity will remain unknown. **There are no wrong answers.** Please complete these 23 questions and return to your plant representative **before April 6**. Once you return your completed survey, you will receive a ticket to exchange for a small gift. Please complete all of the questions even if you don't know the answers. Again, this is voluntary and will not reflect negatively upon you if you chose not to participate, but the answers you provide will not only help my project, but will also help to identify what is important to you as a Bosch employee.

Thank you for taking the time to consider this survey. If you would like to know the results of the survey after the study is complete, please call Charlette Clark at 423-461-4620 (Johnson City) or contact your Health Safety & Environment department. Once again thank you and have a great day.

Sincerely,

Charlette Clark

APPENDIX C

EMPLOYEES' COMMENTS AND SUGGESTIONS

Open responses from all plants for:

“If you have any suggestions for how your plant can reduce waste, please write below”

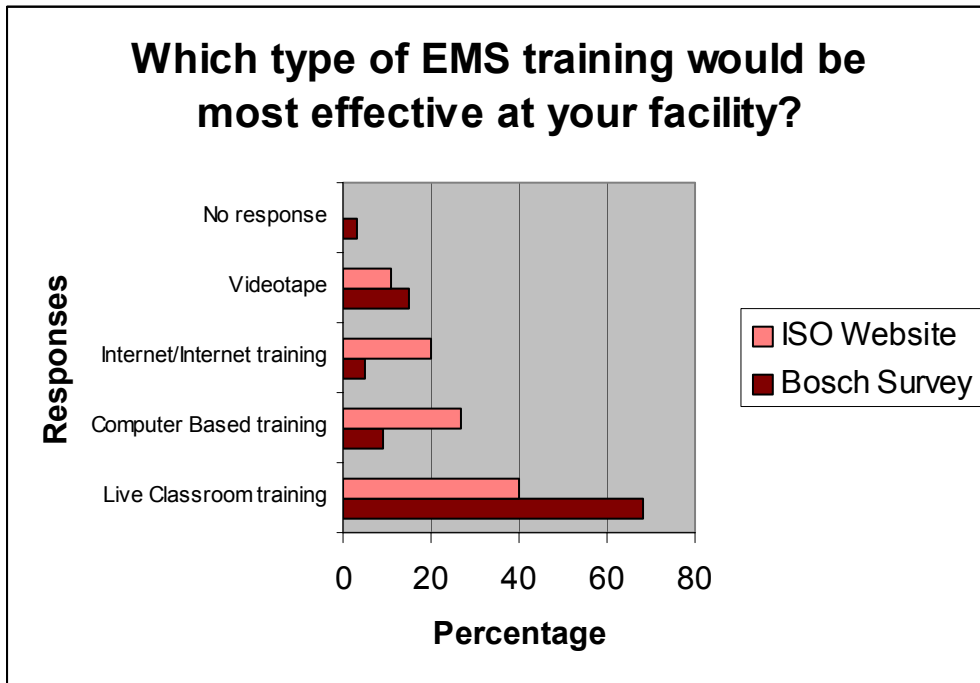
(Answers below are direct quotes unless otherwise noted with { })

<u>Comments from Johnson City</u>	<u>Comments from Ashland</u>
Less paper waste	When I first came here, they had boxes to recycle paper- janitors were just throwing {them} in regular trash so we quit trying to recycle. Should have been enforced
More efficient workshop sinks for production areas for water conservation	Management arrogance needs to disappear to allow teamwork
Use more defective parts for services	Consolidation of products
Turn machines and air blow-off when not in use. We waste a lot of electricity	{Questions 11: an associate said that} choices given go hand in hand and should not be ranked. Quality medical care is diminished without the preventive maintenance of environmental protection.
Treat the people better and they would be more open to change	{Question 16 an associate stated that} Bosch wouldn't keep their word on a temporary pay reduction
I have not really had much exposure to this subject other than what I consider obvious. This is not just at Bosch but former employers also	
<u>Comments from South Bend</u>	<u>Comments from Sumter</u>
{many employees for questions # 7 said it depended upon a plant's size (spending question)}	None at this time, requires more thought. Thanks for the survey
Don't distribute so silly gifts for answering this form, this {is} absolutely waste!!! This goes 2 days in the trash which is not environmentally friendly!!!	We waste alot of cardboard boxes ect. We need to start recycling again and use that money to better our plant
Enhance paper recycling efforts. Provide recycling for associate home products	Recycle pallets, cardboard, plastics covers off piston end of m/c protectors
Establish recycling centers for all suppliers, not just paper. Make it open for associates to bring from home also (within reason)— respondent also said for # 16 that they should not receive a set back {in pay} because the employer did not act correctly and has to remediate or fix something	Training people, people keep eyes on work and stop playing

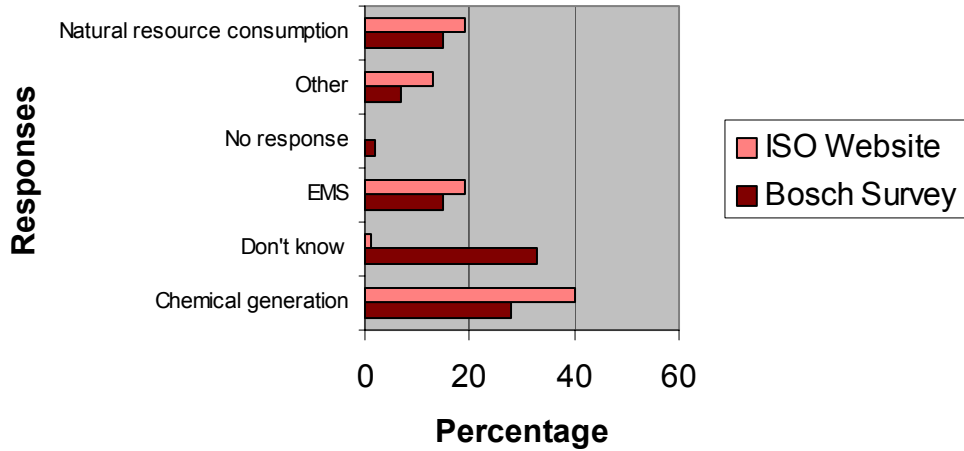
<u>Comments from South Bend</u>	<u>Comments from Sumter</u>
Reuse cooling water sent to drain on test stand heat exchangers	Do more recycling, i.e. cans, gloves
We now use fresh water to cool our hydraulic equipment. I would like to see a “recycling” system using a cooling tower	Think of ways that can prevent waste so we won’t have any waste problem to start with
Paper use reduction	Better training
Don’t print electronic files- view on line (where they’re searchable/changeable ect). Don’t leave lights and PC’s on overnight. Recycle	Reduce waste by source reduction- don’t run bad parts to have waste
Have recycle bin for cans. Use dishes instead of plastic in cafeteria	Have everyone up to date on the do’s and don’ts concerning waste in our plant
Analyze resources used in our operation and develop plans to reduce/reuse/recycle	Eliminate redundant records (hardcopies)
South Bend- needs to recycle plastic bottles now that most pop machines were changed over to 16 oz plastic from aluminum	Waste fluids recycling- reduce paper usage- give everybody a printer and limited paper
Give the people who take this survey some information on ISO 14000	Recycle cardboard/use returnable dunnage
We’ve changed pop dispensers from cans to plastic bottles but there is no advertised in-plant method to recycle the containers like there is for aluminum cans	Recycle cans etc. (box)
{regarding questions 22} There will be an increased cost of the product, in all probability, so unless the competition is also required to follow the same rules, we will experience a competitive disadvantage	Machine maintenance is very poor. Therefore many machines spew coolant, lubricant and other pollutants. This is wasteful and dirty and should be corrected
Stop setting thing {s} up and then taking {them} down to more {move perhaps?} and set up again. Stop throwing away good material that could be reused	Reuse of pallets, cardboard slip papers, gayloards- I could go on all day- use them once and crush them
Better way to dispose and clean up fluid spills in the lab	Fewer surveys!
Paperless office systems (including prints, reports, etc) better energy management	Coolant recycling
The manufacturing should be moved back up north since the water (environment) is already ruined and leave the south so it can become clean as it once was before too much damage is done. Industries that are polluting should pack up their carper bags and leave the south.	Coolant recycling and cardboard recycling
	Everyone working together to reduce waste

APPENDIX D

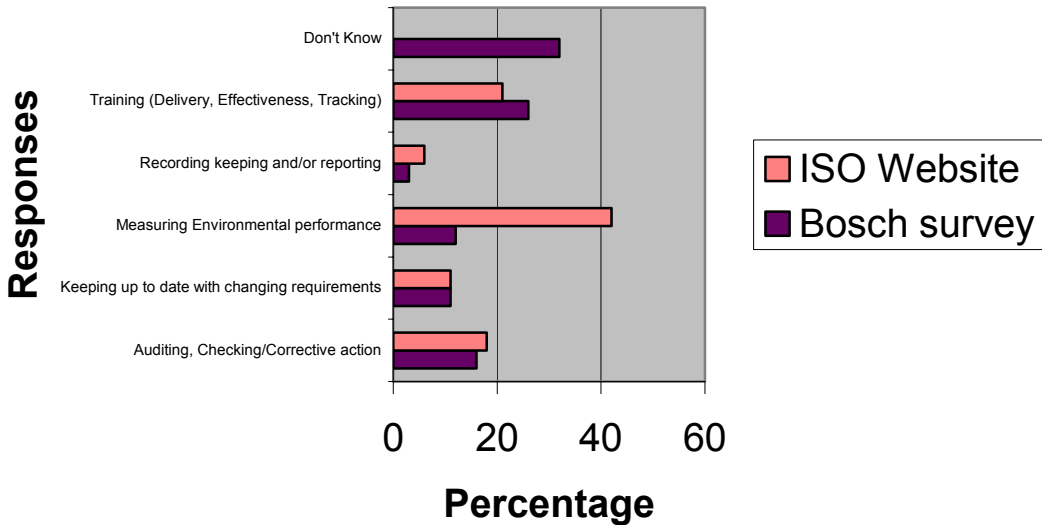
RESULTS FROM ISO 14000 QUESTIONS ADOPTED FROM WEBSITE



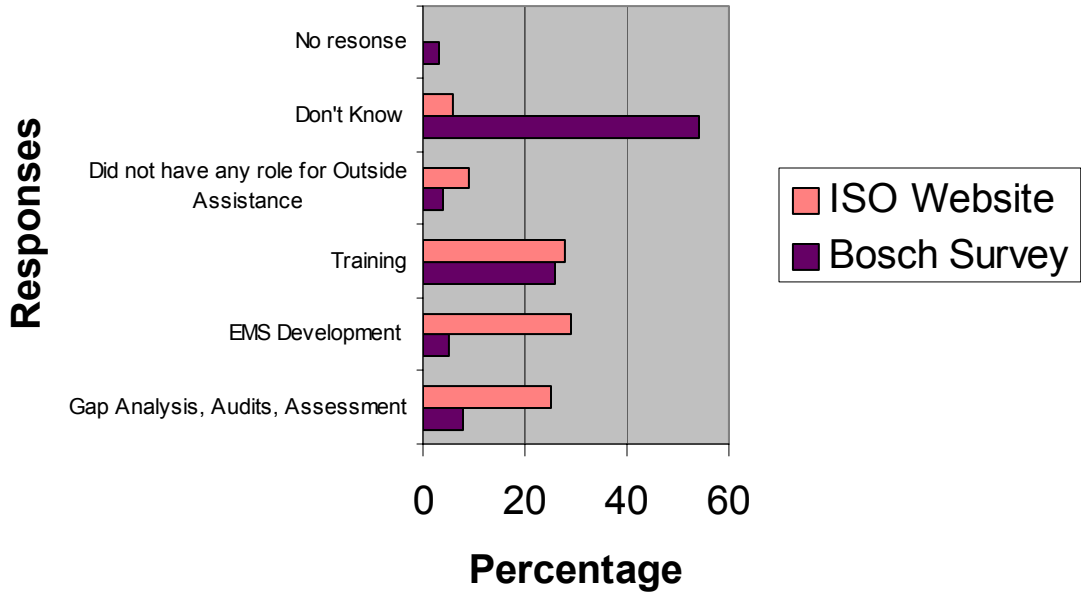
Which type of environmental performance/practice could be most improved at your organization?



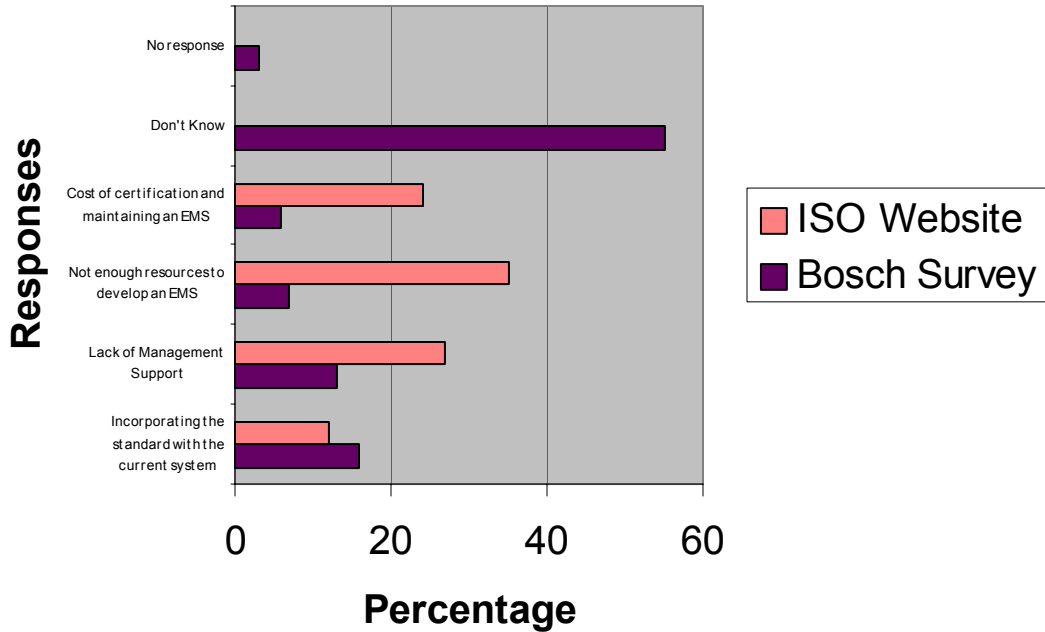
Which area of environmental management could be most improved at your company?



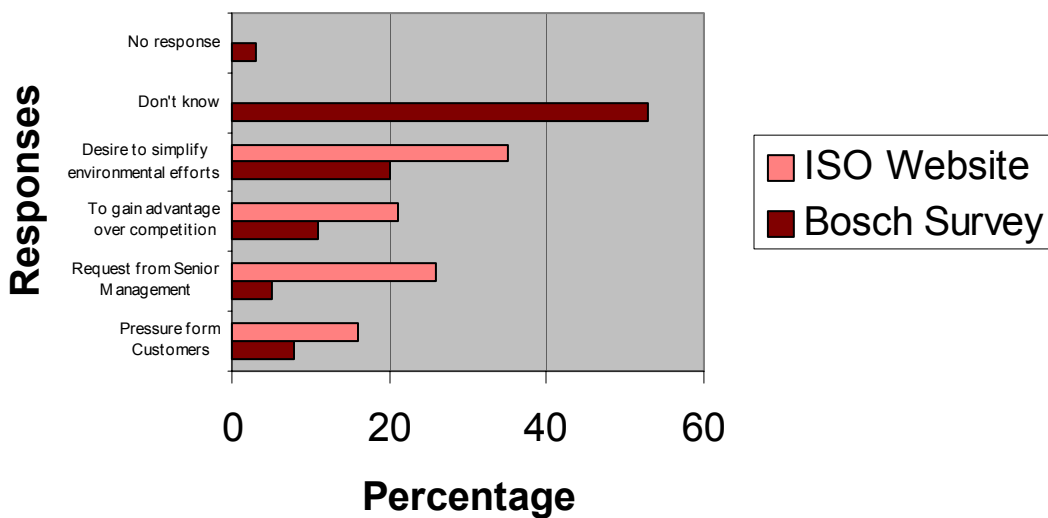
What role is most important for outside ISO 14000 consulting at your site?



While pursuing certification, what do you see as your major obstacle?



In pursuing registration to the ISO 14001 standard, which most influenced your decision?



VITA

CHARLETTE M. CLARK

Personal Data: Date of Birth: January 11, 1974

Place of Birth: Knoxville, Tennessee

Marital Status: Single

Education: Powell High School, Powell, Tennessee

Tennessee Technological University, Knoxville, Tennessee;

Geology, B.S., 1997

East Tennessee State University, Johnson City, Tennessee;

Environmental Health, M.S., 2001

Professional

Experience: Intern, Lockheed Martin; Oak Ridge, Tennessee, 5/1995-8/1995

Intern, ATSDR; Atlanta, Georgia, consecutive summers of 1996 and 1997

Project Manger, PEER Consultants; Oak Ridge, Tennessee, 5/1998-11/1998

Assistant to Environmental Specialist, Johnson City Power Board; Johnson
City, Tennessee, 05/1999-08/1999

Graduate Assistant, East Tennessee State University, College of
Environmental Health, 1999–2001

ISO 14001 Coordinator, Bosch Braking Systems; Johnson City,
Tennessee, 2000-2001

Honors and

Awards: Epsilon Nu Eta.