MANAGEMENT PERCEPTIONS OF THE SAFETY
CULTURE IN LOGISTICS AT SANDIA
NATIONAL LABORATORIES

by

Cynthia Kajder

A Thesis
presented in partial fulfillment
of the requirements for the degree of
Master of Science
In the Safety Sciences Department
Central Missouri State University

March, 2005

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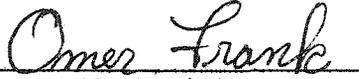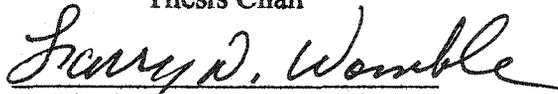
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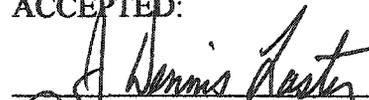
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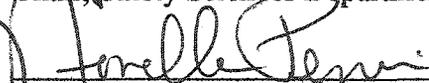
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ABSTRACT

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The stage of a safety culture and management practices leads to desired adjustments in an organization for continuous improvement towards a world class safety culture. The purpose of this research was to assess management perceptions of the current safety culture in the Logistics organization at Sandia National Laboratories. A Likert perception survey was utilized to gather data on management practice elements and to classify the maturity level of the culture. The data indicated that management commitment was optimally being performed and provided a strong base for positive change. Other elements were of concern: communication and feedback, training, worker participation, reward system and a safety-conscious attitude. Logistics was on the edge of a changing safety culture and is ready to advance the safety mission. The evaluation of management practices and safety culture provided for a context of action to pursue a higher safety goal.

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CHAPTER 1
NATURE AND SCOPE

Sandia National Laboratories (Sandia) is a multiprogram laboratory operated by

Sandia Corporation (Sandia), a Lockheed Martin company, for the United States (U. S.)

Department of Energy's National Nuclear Security Administration. Sandia has major

research and development responsibilities in national security, energy and environmental

technologies, and economic competitiveness. The Sandia Logistics organization is a part

of Sandia and is comprised of multiple departments servicing the entire corporation.

Receiving, physical distribution, materials management and shipping comprise the

central core of Logistics. Receiving involves the unloading of freight from common and

contract carrier vehicles and the subsequent physical distribution to the final destination.

Materials management is engaged in the storage and internal movement of radioactive,

nuclear, explosive and other hazardous materials throughout the Sandia site. The

shipping and packaging department includes the review and classification of hazardous

materials per Department of Transportation regulations for hazardous materials in

commerce. Sandia ships hazardous and non-hazardous freight domestically and

internationally. Logistics personnel are trained and qualified to assure compliance with

regulatory requirements.

Although Sandia is technically a single corporate entity, the responsibility for

Environmental Safety and Health (ES&H) is factored down to the lowest line

management levels in the organization that leads to compartmentalization of

responsibility for ES&H. There is a corporate-wide ES&H program that places a great

deal of emphasis on the value of consistency toward the application of procedures and

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behavioral rules throughout the entire corporation. Logistics does not have an assigned organizational ES&H representative. Rather, there is a shared division-wide ES&H representative who is responsible for safety oversight of the entire division. Refer to Figure 1, Logistics Organizational Chart, for an overview of the organization.

Figure 1: Logistics Organizational Chart
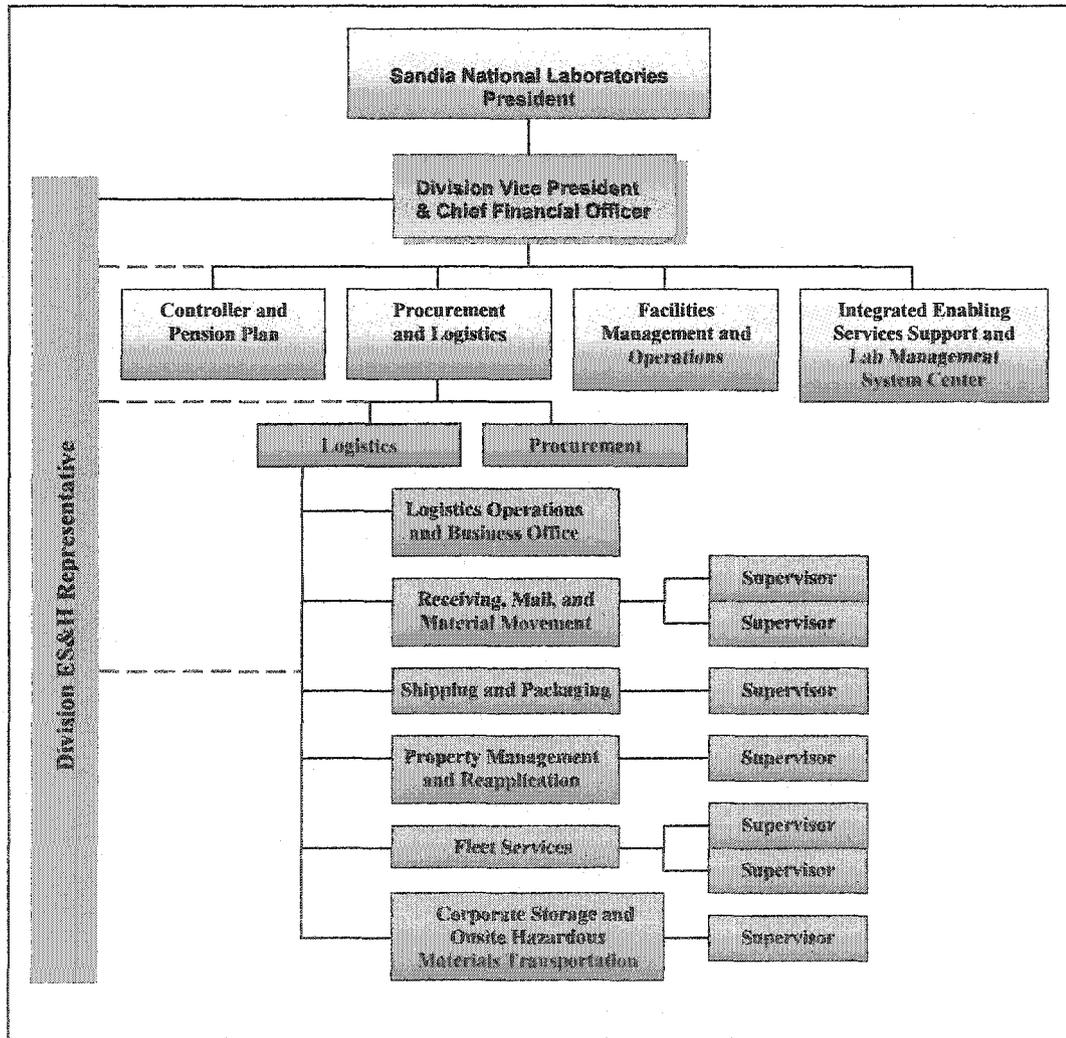
The safety indicator in Logistics reveals a rising trend in work-related injuries. Safety incidents rose from twenty in the year 2000 to forty-six incidents in the year 2004. This increasing trend has the attention of Logistics management. Researchers have found a direct link between safety culture and safety performance. Safety culture, or the collection of characteristics and attitudes towards safety, needs to be measured to understand the next steps towards developing an improvement in a safety program. Management practices should be reviewed to identify strengths and weaknesses. In addition, the maturity or stage of the safety culture requires evaluation. The Logistics organization has a safety program that is compartmentalized and has an increasing trend in safety incidents. A safety culture survey is required to assess the maturity of the safety culture and to evaluate the strengths and weaknesses of management practices.

Purpose of the Research

The purpose of this research was to assess management perception of the current safety culture in the Logistics organization at Sandia National Laboratories. In particular, the study intends to answer the following questions:

1. What management practice elements are optimally being performed?

2. What management practice elements are of concern and need improvement?

3. What is the current stage of the safety culture based upon the perceptions of Logistics management?

Hypothesis

This research study has identified the following directional hypotheses:

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H1: The average value score of perceptions of the management practice element of management commitment meets or exceeds the optimal average related performance score equivalent to the numerical value of 4 or above on the Likert scale.

H2: The average value score of perceptions of the management practice element of communication and feedback meets or exceeds the optimal average related performance level score equivalent to the numerical value of 4 or above on the Likert scale.

H3: The average value score of perceptions of the management practice element of training meets or exceeds the optimal average related performance level score equivalent to the numerical value of 4 or above on the Likert scale.

H4: The average value score of perceptions of the management practice element of worker participation meets or exceeds the optimal average related performance level score equivalent to the numerical value of 4 or above on the Likert scale.

H5: The average value score of perceptions of the management practice element of a reward system meets or exceeds the optimal average related performance level score equivalent to the numerical value of 4 or above on the Likert scale.

H6: The average value score of perceptions of the management practice element of a safety-conscious attitude meets or exceeds the optimal average related performance level score equivalent to the numerical value of 4 or above on the Likert scale..

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H7:   The average value score of management perceptions for the characteristics of the three stages of safety culture results in the categorization of the Logistics safety culture within the Stage II level.

Significance of Study

Understanding the perceptions of management of the safety culture in Logistics provides a measure for the basis of the safety climate, or a quick picture of worker perceptions, attitudes and beliefs regarding safety. Evaluating the safety culture, or the underlying values and norms in an organization, provides for a context of action to pursue a higher goal. These goals could be qualitatively identified as increased safety awareness or quantitatively identified as decreasing accident and injury statistics over a period of time.

Logistics management is comprised of both managers and supervisors who interact daily with workers. This is better known as the line management level in an organization and is a crucial part of the corporation. According to William C. Pope (1990), the supervisor is the contact between the employee and the employer on a daily basis. (p. 12). Safety management in the Logistics organization resides primarily with the line management. In addition to managers and supervisors, Logistics management includes the support staff of technical employees that interact daily with the workers. The support staff provides guidance to employees on the line and was included in the survey under the term Logistics management. Staff employees often take the role of a supervisor or a manager through direct instructions to line employees. The collective grouping of Logistics management to include managers, supervisors and staff affords a perception from those that interact daily with line workers.

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The significance of this research was to assess management practice elements and the maturity of the safety culture in Logistics based on the perceptions of Logistics management. Together, the perceptions of management practices and the stage of safety culture can lead to desired adjustments in an organization resulting in both quantitative and qualitative improvements in safety measures.

Assumptions

Sandia is aware of the importance of safety in the management and operation of the work in the Logistics organization. The following assumptions were key critical parts of this research:

1. The survey is a valid and reliable instrument for assessing the perceptions of management.

2. All participants' confidentially are maintained throughout the survey process.

3. All participants are provided an informed consent form.

4. The responses to the survey are an accurate reflection of management perceptions of the safety culture in Logistics.

Limitations

The following limitations were identified:

1. The survey will be administered by a safety professional in a different testing environment which may be less than ideal.

2. Results may be influenced by the participants' time in the position, area of expertise, education level, and prior experience.

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3. The selection of subjects is comprised of the total population of employees of Sandia Logistics categorized as a manager, supervisor or staff.

Definitions of Terms and Acronyms

The following terms and acronyms are defined to clarify the terminology used in this study:

Attitude: A state of mind or feeling with regard to some matter. An expressed commitment towards safety. (Cooper, 1998, p. 27).

CF: The management practice of communication and feedback.

CFR: Code of Federal Regulations.

Components: The individual elements or management practices in a safety program including communication and feedback, management commitment, reward system, safety-conscious attitude, training and worker participation.

Culture: The practices common to a group of people. The way people do things and the reasons they do them. (McSween, 2003, p. 21).

DOT: Department of Transportation.

ES&H: Environmental Safety and Health.

Fiscal Year 2005: The period from October 1, 2004 through September 30, 2005.

Hazardous Material: Hazardous material means a substance or material that the Secretary of Transportation has determined is capable of posing an unreasonable risk to health, safety, and property when transported in commerce, and has designated as hazardous under section 5103 of Federal hazardous materials transportation law (49 U.S.C. 5103). The term includes hazardous substances, hazardous wastes, marine pollutants, elevated temperature materials, materials

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designated as hazardous in the hazardous materials table (see 49 CFR 172.101), and materials that meet the defining criteria for hazard classes and divisions in part 173 of subchapter C of this chapter. (U. S. Department of Transportation, Title 49 CFR §171.8).

ISMS: Integrated Safety Management System. A formal framework used to manage Sandia operations. Refer to Appendix A, Characteristics of Stages of Safety Culture.

Improvement: On the Likert scale of 1 - 5, an average score less than 4. Indicates a performance level not acceptable to management.

Leading Indicator: A measurement of safety which is linked to preventive actions. (Toellner, 2001, p. 42).

Logistics: The process of planning, implementing, and controlling the efficient, effective flow and storage of goods, services, and related information from the point of origin to the point of consumption (Coyle, Bardi, & Novack, 2000, p. 3).

Logistics Organization: Receiving, physical distribution, materials management and shipping comprise the central core of the Logistics organization at Sandia.

Logistics Management: Managers, supervisors, and staff employees within the Logistics organization that have direct contact with line employees.

MC: The management practice of management commitment.

Management Practices: Components or elements of a safety program given that each contributes to effective safety management and is prevalent in the safety culture of organizations that have low injury rates. These include communication and feedback (CF), management commitment (MC), reward system (RS), safety-

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conscious attitude (SC), training (TR) and worker participation (WP) (Vredenburgh, 2002, pp. 261-262).

Materials Management: Function of Logistics that is concerned with the movement and storage of raw materials and products. (Coyle et al., 2000, p.14).

NORM: Naturally Occurring Reactive Management. A level of safety organization (Hansen, 1993 March, pp. 19-20).

OSHA: Occupational Safety and Health Administration, U. S. Department of Labor.

Optimally Performed: On the Likert scale of 1-5, an average score of 4 to 5. Indicates a performance level acceptable to management.

Perception: To become aware of in one's mind; achieve understanding of; marked by discernment and understanding. Perceptions are based on complex interactions between a multitude of physiological, psychological and environmental influences (Cooper, 1998, p. 27).

Physical Distribution: Function of Logistics that involves the disbursing of materials to storage or to other organizational functions requiring them. (Tompkins, White, Bozer, Frazelle, Tanchoco, & Trevino, 1996, p. 392).

RS: The management practice of reward system.

Receiving: The collection of activities involved in the orderly receipt of all materials coming into a warehouse and providing the assurance that the quantity and quality of such materials are as ordered. (Tompkins et. al., 1996, p. 392).

SC: The management practice of safety-conscious attitude.

Safety Climate: A reflection of safety culture, often assessed by gathering information through questionnaires or surveys that provide a quick picture of worker

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perceptions, attitudes and beliefs regarding safety. (Sarkus, 2001, p. 20). Safety climate emphasizes the perceptions held by employees regarding the importance of safety in their organization (DeJoy et al., 2003, p. 81).

Safety Culture: An organizational environment in which people do their tasks safely and for the right reasons. Employees perform tasks safely to prevent injury to themselves and others, not merely because of pressure from managers. (McSween, 2003, p. 21). Includes the underlying assumptions, values, norms and expectations within a given organization (Sarkus, 2001, p. 20).

Safety Culture Stage Characteristics: Elements or behaviors that exist in an organization as correlated to the stages of safety culture. Refer to Appendix A, Characteristics of Stages of Safety Culture.

Safety Indicator: A measurement of safety. Includes both leading indicators and trailing (or lagging) indicators. (Toellner, 2001, p. 42).

Sandia National Laboratories (Sandia): Sandia National Laboratories is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin company, for the U. S. Department of Energy's National Nuclear Security Administration. Sandia has major research and development responsibilities in national security, energy and environmental technologies, and economic competitiveness.

Shipping: Function of Logistics that includes: packaging materials in an appropriate shipping container, preparing shipping documents and bill of lading, arranging for outbound carriers, negotiating freight rates, loading trucks. At Sandia, shipping

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also involves the technical evaluation of materials for their hazard properties to determine if the item is a hazardous material in transit.

Stages of Safety Culture: The varying levels of maturity of safety culture in an organization that represents the developmental stages of a safety culture. (Carnino, n.d., pp. 3-5). These stages include:

Stage I Safety Culture: Safety solely based on rules and regulations.

Stage II Safety Culture: Good safety performance becomes an organizational goal.

Stage III Safety Culture: Safety performance can always be improved.

Storage: The physical containment of material that is awaiting a demand; may include both long-term and short-term storage. The form of storage depends on the size and quantity of the items in inventory and the handling characteristics and hazards of the product or its container. (Tompkins et. al., 1996, p. 393).

SWAMP: Safety Without Any Management Process. A level of safety organization (Hansen, 1993 March, p. 19.-20).

TR: The management practice of training.

Trailing (or lagging) Indicator: A measurement of safety which is linked to the outcome of an accident. The most common trailing indicators are driven by the Occupational Safety and Health Administration (OSHA) and include, for example, total recordable index, lost-time index and number of days restricted. (Toellner, 2001, p. 42). The Logistics organization at Sandia uses trailing indicators as safety indicators.

WP: The management practice of worker participation.

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CHAPTER 2

REVIEW OF LITERATURE

The concept of safety culture was developed as a result of the 1986 Chernobyl accident. This accident focused attention on the human and organizational elements which contributed to an unsafe operation of technical systems (Vredenburgh, 2002). Vredenburgh (2002) discusses that safety culture is a process, not a program, and it takes time to develop and implement changes in attitudes, beliefs and practices in an organization. Many researchers have found a direct link between organizational performance and organizational culture.

Safety Culture

The theory of safety culture is often discussed in the Bandura model of reciprocal determinism. In the model, there are three elements which envelop safety culture: subjective internal psychological factors, observable on-going safety related behaviors, and objective situational features. Employees attitudes and perceptions, or safety culture, is represented as the internal psychological factors in an organization and are assessed through safety climate questionnaires. On-going safety related behavior is evaluated with checklists, and situational features are reviewed safety management system audits. In the *Safety Science Journal*, M. D. Cooper (2000) discusses the relationship of safety culture and the Bandura model. The Bandura model is a framework used to analyze organizational safety culture. M. D. Cooper states that "the psychological, behavioural, and situational elements of the model precisely mirror those accident causation relationships found by a number of researchers" (p. 6). Safety culture takes into account

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the subjective, observable, and objective features of the Bandura model. A questionnaire is one way to measure or quantify the safety culture in an organization. M. D. Cooper (2000) discusses this as the "triangulation" methodology which looks at multi-level analyses (p. 6). Figure 2, Bandura's Model of Reciprocal Determinism, shows a graphical illustration of the model.

Figure 2: Bandura's Model of Reciprocal Determinism
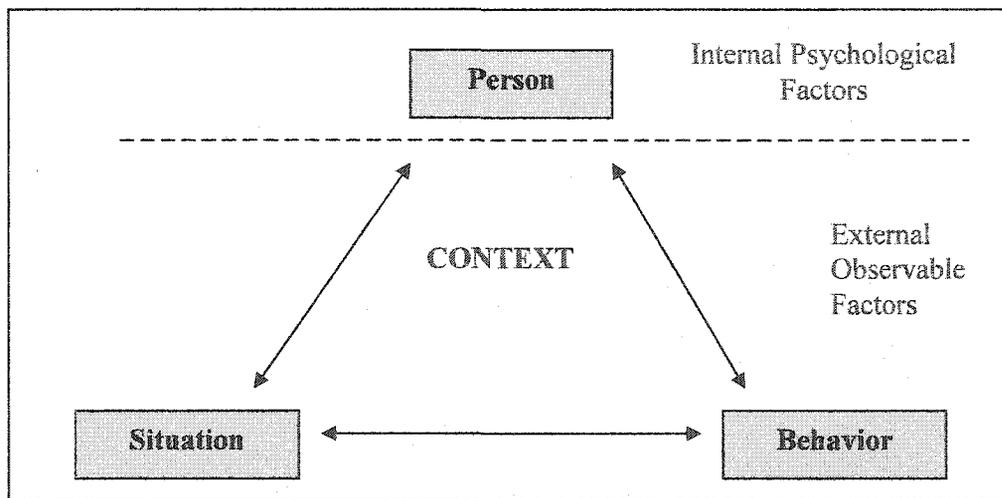
(Cooper, M.D., 2000, p. 5)

Safety culture, or the collection of characteristics and attitudes towards safety, has to be ingrained in the thoughts and actions of all individuals in an organization. Management leadership is essential in the development of a strong safety culture and often results in a more effective conduct of work and a sense of responsibility among employees and management. There are varying levels of maturity of safety culture in an organization. Methods to change or move the stage or maturity level of safety culture in an organization may be accomplished either through the highest level of management or

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from the bottom level or the worker level. Cooperation and two-way communication at all levels of the organization is essential to necessitate changes in safety culture.

Carnino (n.d.) of the International Atomic Energy Agency explains that there are three levels that represent the developmental stages of safety culture (pp. 3-5). These levels each display a different awareness and receptiveness to the effect of human behavior and attitudes on safety. The first level, or Stage I, is described as an organization that sees safety as an external requirement and not as an integral part of work to help the organization succeed. Safety is primarily based on rules and regulations. Improving safety performance is not a priority of the organization. Safety culture characteristics for Stage I include an adversarial relationship between management and employees and safety is viewed as a required nuisance (Carnino, n.d., pp. 3-5).

A Stage II safety culture as explained by Carnino (n.d.) is "good safety performance becomes an organizational goal" (p. 4). Management perceives safety performance very important even without regulatory pressures. Safety performance is goal-oriented and management matrixes to other organizations to seek advice to improve safety performance. Characteristics of a Stage II safety culture include management backing of cross-departmental or cross-functional teams and effective communication. In addition, an organization concentrates primarily on day to day work with a lack of focus on long-term strategies (Carnino, n.d., pp. 3-5).

An organization in Stage III looks at continuous improvement strategies applied to safety performance. Behaviors in the organization enables safety improvements to take place, and "there is a strong emphasis on communications, training, management style, and improving efficiency and effectiveness" (Carnino, n.d., p. 4). One

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characteristic of a Stage III organization is the sense of ownership; both employees and management are working together towards common goals. Employees are rewarded for improving processes. Management takes a more active role in analyzing short-term safety performance to identify changes that will improve long-term performance.

These three stages of evolution of safety culture can be used as a basis to evaluate which stage an organization has reached. Appendix A, Characteristics of Stages of Safety Culture, highlights the safety characteristics for evaluating each stage of safety culture. By understanding where a particular organization is with respect to safety culture, the more effective an organization is able to identify possible changes for improvement. Carnino (n.d.) cautions that "sufficient time must be taken in each stage to allow the benefits from changed practices to be realized and to mature" (p. 5).

Safety Management

Safety management is the term used for the measures required to ensure that an acceptable level of safety is maintained throughout an organization (Carnino, n.d., p.2). In the *Journal of Safety Research*, Vredenburgh (2002) identifies six management practices that are consistently discussed in research studies. These include worker participation, safety training, hiring practices or safety-conscious attitude, reward system, management commitment, and communication and feedback. These six elements each contribute to effective safety management and are prevalent in the safety culture of organizations that have low injury rates (Vredenburgh, 2002, p. 261).

The first of these six management practices is worker participation which involves those employees that are closest to the work environment and are recognized as being the best qualified to make suggestions about improvements. Employee

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participation is achieved through safety committees and teams, but those teams must be given the authority to implement change. Employees must also receive relevant safety training and when workers receive more training, accidents are more predictable (Vrendenburgh, 2002, p. 262). Worker participation is one of the key elements in an effective safety program.

Hiring practices, or being safety conscious, also influences safety management. When hiring new employees, management should strive to find workers that have a safety-conscious attitude in their work. Bringing in a safe attitude contributes positively to the safety culture of the organization and promotes an organizational environment in which people do their tasks safely and for the right reasons (McSween, 2003, p. 21). An effective reward system should be in place to reinforce the desired behaviors as well as a discipline system to deal with undesirable behaviors.

Management commitment is a key variable in a safety management program. Vredenburgh (2002) explains that "management's commitment to safety is a major factor affecting the success of an organization's safety program" (p. 263). Management commitment could be as simple as being involved in safety committees or reviewing safe work practices. The level of involvement must be sincere. Management commitment is more than a passive state; it is proactive involvement, understanding what is right and having the willingness to act on what is wrong (Hansen, 1993 Sept.). Effective and honest communication between workers and management is vital to develop trust. Feedback must be used to communicate to employees to influence behaviors.

These six management practices individually and collectively contribute to an effective safety management program. These practices alone will not result in an

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effective safety management system, but must be infused into the organization. According to Souter (1997), "An effective safety management system should have the same characteristics as a stealth bomber: quiet, penetrating, highly effective and hardly noticeable" (p. B1). Companies are at varying degrees of implementing safety management programs. In fact, Hansen (1993 March) refers to some companies as SWAMP organizations, Safety Without Any Management Process (p. 19). SWAMP is designated for those companies that view safety accidents as a cost of doing business and have minimal employee involvement in safety management (Hansen, 1993 March, p.19)

Hansen (1993 March) further explains that many companies move beyond this SWAMP level of safety management to the NORM level, Naturally Occurring Reactive Management (pp. 19-20). A NORM company implements safety activities without having an understanding of the problems or actions needed to resolve them. The NORM level typically uses inspection techniques to evaluate safety and does not identify the root problems to focus on. The highest level that companies strive for is known as an outstanding, first-class, top-notch, or world class safety program. This program is characteristic of management that perceives safety as a good business investment. Hansen (1993 March) further indicates that world class safety organizations have effectively managed change (p. 20). World class companies are known as the leaders, and only seven percent of all companies have employed truly progressive approaches to safety management (Hansen, 1993 March, p. 18.). Companies having top-notch safety programs often benchmark with other companies.

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Safety Programs

A safety program is nothing more than a safety system. Petersen (1996) discusses four types of safety programs as related to the characteristics of a company. The overzealous company often overexposes their employees to safety and a rewarding company may offer rewards or prizes to support safety behaviors. Petersen continues to explain that a lively company uses competition between departments or divisions to improve safety, and lastly, the negligent company develops a safety program after a major safety incident (pp. 54-55). There are many types of safety programs discussed in literature such as: BBS – Behavior Based Safety, ISMS – Integrated Safety Management System, Safety Committees, Safety Circles, and Safety Value Based Systems. At Sandia, an ISMS program is implemented throughout the corporation and department managers have primary responsibility for the health and safety of the personnel. Refer to Appendix B, Integrated Safety Management System (ISMS), for an overview of the Sandia ISMS program. Regardless of which safety program is used by a company, the basic components of a safety system or program must be understood.

The Occupational Safety & Health Administration (OSHA) eTool system (2004) identifies the components of a safety system as the following:

- A system is an established arrangement of components that work together to attain a certain objective, such as preventing injuries and illness in the workplace; and,

- Within a system, all parts are interconnected and affect each other.

All the pieces of a safety system are related and connected and must work together collectively. The National Institute for Occupational Safety and Health (NIOSH)

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Publication 2004-135 identifies four key components in a safety system (NIOSH, 2004). These include management leadership and employee involvement, safety and health training, worksite analysis and hazard prevention and control. These are shown below in Figure 3, NIOSH Elements of a Safety and Health System.

Figure 3: NIOSH Elements of a Safety and Health System
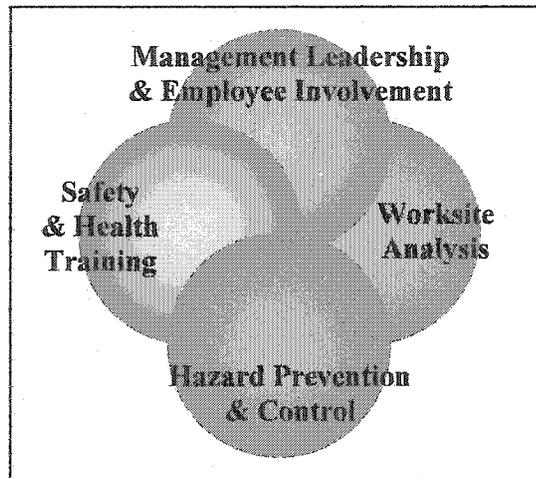
NIOSH Safety & Health Management Systems eTool

Two of the NIOSH elements, employee involvement and management leadership, are represented together because one is not effective without the other. Worker safety must be viewed as a fundamental value of the business. Managers must be visible, accessible, serve as an example to the organization, and involved in the safety program. Employees that are involved and have input into the safety program support and use the safety program. When both managers and employees are held accountable for their safety responsibilities, solutions to issues that arise are easily attainable. Training is the backbone of the system. Resources are provided by management to perform worksite

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hazard analysis and to enable employees to find the hazards to eliminate or control those hazards. Basically, a safety program works through these elements in a structured process, similar to the one presented in Figure 4, NIOSH Continuous Evaluation of Safety. Regardless of what type of safety program is implemented at a company, this continuous evaluation of safety processes, issues, incidents, and employee concerns forms the core of the safety system or safety program in an organization.

Figure 4: NIOSH Continuous Evaluation of Safety

NIOSH Safety & Health Management Systems eTool
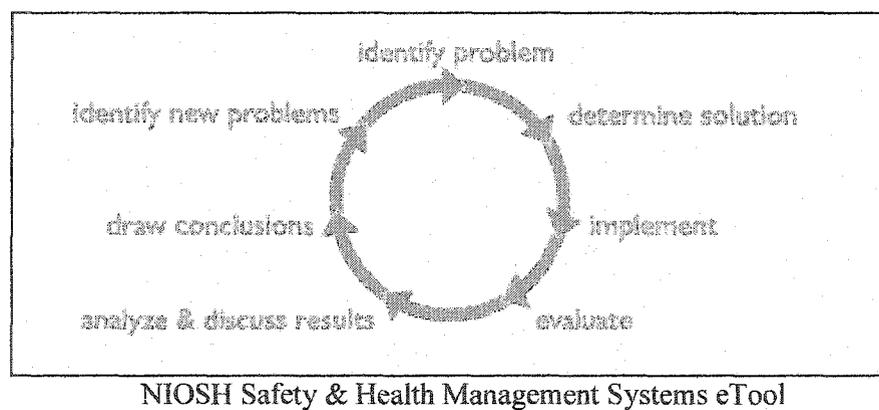
Evaluating Safety

In the NIOSH publication *Guide to Evaluating the Effectiveness of Strategies for Preventing Work Injuries*, Robson, Shannon, Goldenhar, and Hale (2001) point out that employee surveys often measure what cannot otherwise be observed (p. 60). Surveys assess group climate or culture and examine the knowledge, attitudes, beliefs, or perceptions held by individuals. Dominic Cooper (1998) stresses in the book *Improving Safety Culture* that safety culture is a dynamic entity that is continuously changing, and there is a need for a reliable measuring instrument to evaluate safety culture (p. 26). The

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relationship between perceptions and attitudes about safety are very complex because they are based on an individual's experiences, level of knowledge, beliefs about the causes of accidents, and the amount of control they feel one has over any hazards. There is still a need to know what safety-related attitudes and perceptions employees hold to take the next step towards developing a more proactive safety culture. Understanding perceived support on how an organization is concerned for an employee's overall well-being is one of the tools identified by Krause and Hidley (2003). In addition, Dominic Cooper (1998) notes that management needs to understand employees' perceptions and attitudes towards safety so that management can direct their attention and actions in the most effective manner (p. 26). Measuring employee perceptions is an important element as the basis in the next step for change.

Conversely, management's attitudes and beliefs regarding safety must be considered and understood. Management attitudes towards safety management are an important element in management commitment and those attitudes must be measured to understand the organizational culture. To strive for continuous improvement, management must recognize the issues and culture of an organization (Geller, 1996, pp. 309-310). A perception survey may indicate that management believes that a safety program is effective. On the other hand, a survey may demonstrate the need to change one of the elements of a safety program as highlighted by NIOSH. In *The Psychology of Safety*, Geller (1996) indicates that if a company or an organization does not focus on the real causes of improvement, a company may actually demotivate employees that deserve recognition (p. 309).

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CHAPTER 3
METHODOLOGY

A Likert survey was administered to the management of the Sandia Logistics organization to understand the management perceptions of safety culture. A survey provides a measure for the basis of the safety climate in the Logistics organization. The results were compared to the characteristics of the stages of safety culture to determine the current stage of safety culture in Logistics.

Design of Measurement Instrument

A perception based safety culture survey was distributed to the total population of Sandia Logistics management to obtain honest and objective input. The total population of Logistics management was surveyed which is equivalent to 45 participants. The perception based survey instrument utilized the Likert scale to evaluate perceptions and was comprised of 30 perception questions and one open-ended comment question. Refer to Appendix C, Informed Consent and Safety Perception Survey Questionnaire, to view the survey instrument.

The questions were derived from various information sources including research literature sources, input from the Sandia division ES&H Representative, and the NIOSH eTool on-line questionnaire. Some of the questions were uniquely designed by the author as a product of the researcher's work to encompass a certain characteristic in a particular stage of safety culture or a specific element in a management practice. The survey was professionally validated by an Independent Surveillance Assessment Engineer in the Human Factors and Reliability organization at Sandia for readability and modifications and suggested changes were made to several of the survey statements. The changes were

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incorporated into the final design of the survey instrument. Appendix D, Survey Perception Questionnaire Correlation to Management Practice and Safety Culture Stages, contains a cross-reference chart that correlates the management practices and the stages of safety culture with the individual survey statements.

The survey is easy to understand with written instructions at the beginning. The statements were scored on the Likert scale with five possible choices on a 1 to 5 scale: 5-strongly agree, 4-agree, 3-uncertain, 2-disagree, 1-strongly disagree. The subjects were instructed to circle the number that best signifies their perception to the statement. A copy of the informed consent was provided to each participant. The questionnaire was administered in a meeting by the division ES&H Representative to ensure complete confidentiality. No names were indicated on the survey. A copy of the informed consent is found in Appendix C, Informed Consent and Safety Perception Survey Questionnaire.

<center>Selection of Subjects</center>

The total population of Sandia Logistics management, equivalent to 45 participants, was asked to voluntarily participate. The subjects were informed of the purpose of the survey and how to attain a copy of the results. The targeted population included managers, supervisors and staff in the Logistics organization who interact daily with the workers. Staff employees include professional staff such as engineers and others that are directly involved in interactions with operations personnel. Managers and supervisors, as well as staff employees, provide direction and guidance to line workers and are collectively targeted participants in the safety perception survey.

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Data Interpretation

The data from the Likert survey benefits the Logistics organization by providing the management perspective of safety culture. The data from each statement of the survey was evaluated for an average value based on the number of respondents. Further analysis was performed to average together those survey statements that correspond to the management practice elements. A correlation chart depicting the relation of the survey statement with the various management practice elements is provided in Appendix D, Survey Perception Questionnaire Correlation to Management Practices and Safety Culture Stages. On the scale of 1 to 5, an average score greater than or equal to 4 for the perception of the statements collectively associated to a particular management practice represents a management practice element that is optimally performed. Conversely, an average score of less than 4 was considered as a management practice element that is not optimal and requires improvement.

The data collected for the stages of safety culture provides indicators that can determine the current maturity stage of the safety culture in Logistics. The values for the stages of safety culture are analyzed in the same method. An average is calculated for the survey statements that are associated with each of the three stages of safety culture. A correlation chart depicting the relation of the survey statement with the various stages of safety culture is provided in Appendix D, Survey Perception Questionnaire Correlation to Management Practices and Safety Culture Stages. The particular stage of safety culture that has the highest average value represents the current Logistics stage of safety culture.

Approval by the Human Subjects Review Committee at Central Missouri State University was received on November 2, 2004. A copy of the approval documentation is

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provided in Appendix E, Approval from Human Subjects Review Committee. The Likert

perception survey was administered on November 3, 2004 through November 11, 2004.

The results were tabulated, scored, and compiled by an Independent Surveillance

Assessment engineer at Sandia. All data was treated in the aggregate; no individual data

was tabulated. A report was generated and provided to the Logistics Deputy Director for

discussion and dissemination within the organization. The division 10000

Environmental, Health and Safety Representative reviewed the results which are

representative of Sandia's perceptions of the safety culture in Logistics.

CHAPTER 4
ANALYSIS OF DATA

A perception based instrument was utilized to gather the management perceptions
of both the maturity of the safety culture and the effectiveness of management practices
in Logistics at Sandia National Laboratories. The total population of Logistics
management were surveyed which is equivalent to 45 participants. There were actually
39 participants who responded, resulting in approximately 86.6% participation, which is a
relevant percentage number. After the data was tabulated, the documents were destroyed
to ensure anonymity of the participants.

Management Practice Results

There were six management practices that were evaluated with the perception
survey. These management practice elements include management commitment,
communication and feedback, training, worker participation, reward system and a safety-
conscious attitude. There were five perception statements within the survey instrument
that correlate each management practice. Refer to Figure 5, Management Practices
Correlation to Survey Statements, for a cross-reference of survey statements with
management practices.

Figure 5: Management Practices Correlation to Survey Statements

Management Commitment	Survey Statements 1, 2, 3, 4, 5
Communication and Feedback	Survey Statements 6, 7, 8, 9, 10
Training	Survey Statements 11, 12, 13, 14, 15
Worker Participation	Survey Statements 16, 17, 18, 19, 20
Reward System	Survey Statements 21, 22, 23, 24, 25
Safety-Conscious Attitude	Survey Statements 26, 27, 28, 29, 30

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Only one of the management practices, management commitment, averaged a score of 4.2 which reflects optimal performance. The other five management practice elements were not optimal; the average score was less than 4. The management practices of training and worker participation both scored an average of 3.8, which is close to the optimal average score of 4. Communication and feedback and a safety-conscious attitude both scored an average of 3.6. The lowest average score of 3.2 was for the management practice of a reward system. An average score of less than 4 indicates that improvement in a particular management practice is needed. Figure 6, Results: Management Practices, graphically illustrates the average scores for the management practice elements.

Figure 6: Results: Management Practices

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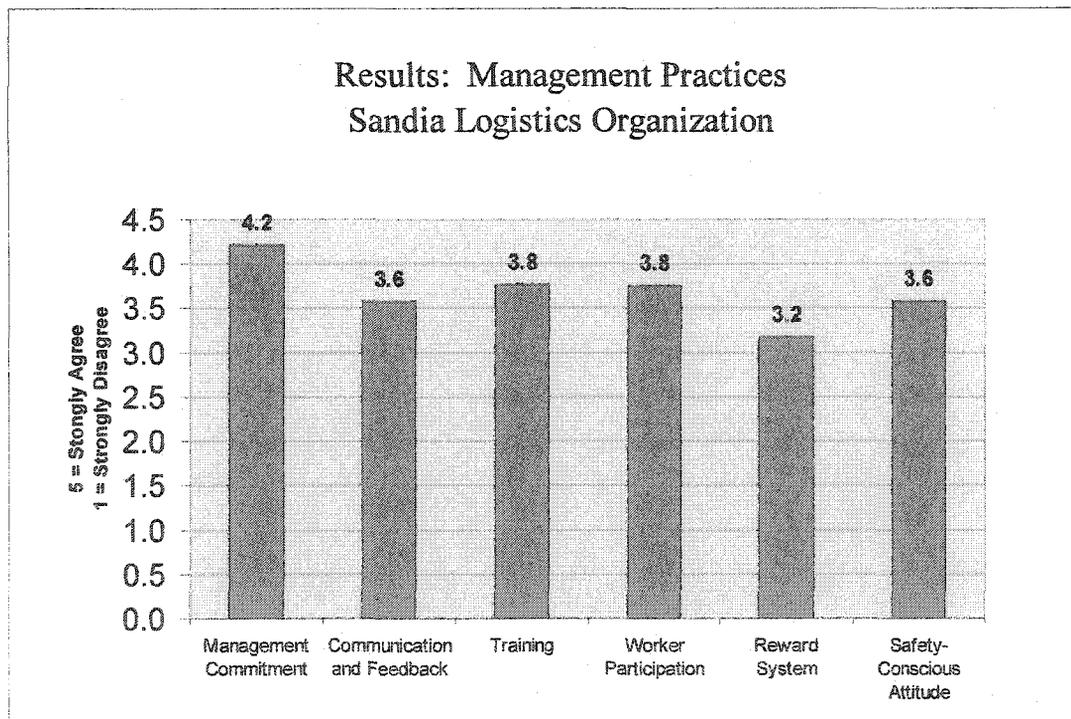
Stages of Safety Culture Results

The perception instrument was also designed to classify the maturity of the safety culture in Logistics in terms of the stage of safety culture. There were ten perception statements correlated to each of the three stages of safety culture. These stages include Stage I – safety is solely based on rules and regulations; Stage II – good safety performance becomes an organizational goal, and Stage III – safety performance can always be improved. Refer to Figure 7, Safety Culture Stages Correlation to Survey Statements, for a cross-reference of survey statements linked with the stages of safety culture.

Figure 7: Safety Culture Stages Correlation to Survey Statements

Safety Solely Based on Rules and Regulations	Survey Statements 8, 11, 12, 13, 14, 17, 23, 25, 26, 28
Good Safety Performance Becomes an Organizational Goal	Survey Statements 1, 3, 4, 5, 6, 7, 9, 10, 15, 29
Safety Performance Can Always Be Improved	Survey Statements 2, 16, 18, 19, 20, 21, 22, 24, 27, 30

An average was calculated for the perception survey statements that correspond to each of the three stages or levels of safety culture. The level of safety culture that has the highest average value indicates the particular stage of safety culture that is current in Logistics. The results of the perception survey indicated that the highest average score is 3.8 and represents Safety Culture Stage II. Therefore, Stage II – good safety performance becomes an organizational goal, is the current classification or level of safety culture in Logistics. Stage III – safety performance can always be improved, resulted in an average of 3.7. The lowest average value was 3.5 for Stage I – safety is solely based on rules and

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regulations. Refer to Figure 8, Results: Stages of Safety Culture, for a graphical illustration of average value results for the three stages of safety culture.

Figure 8: Results: Stages of Safety Culture

Results: Stages of Safety Culture
Sandia Logistics Organization
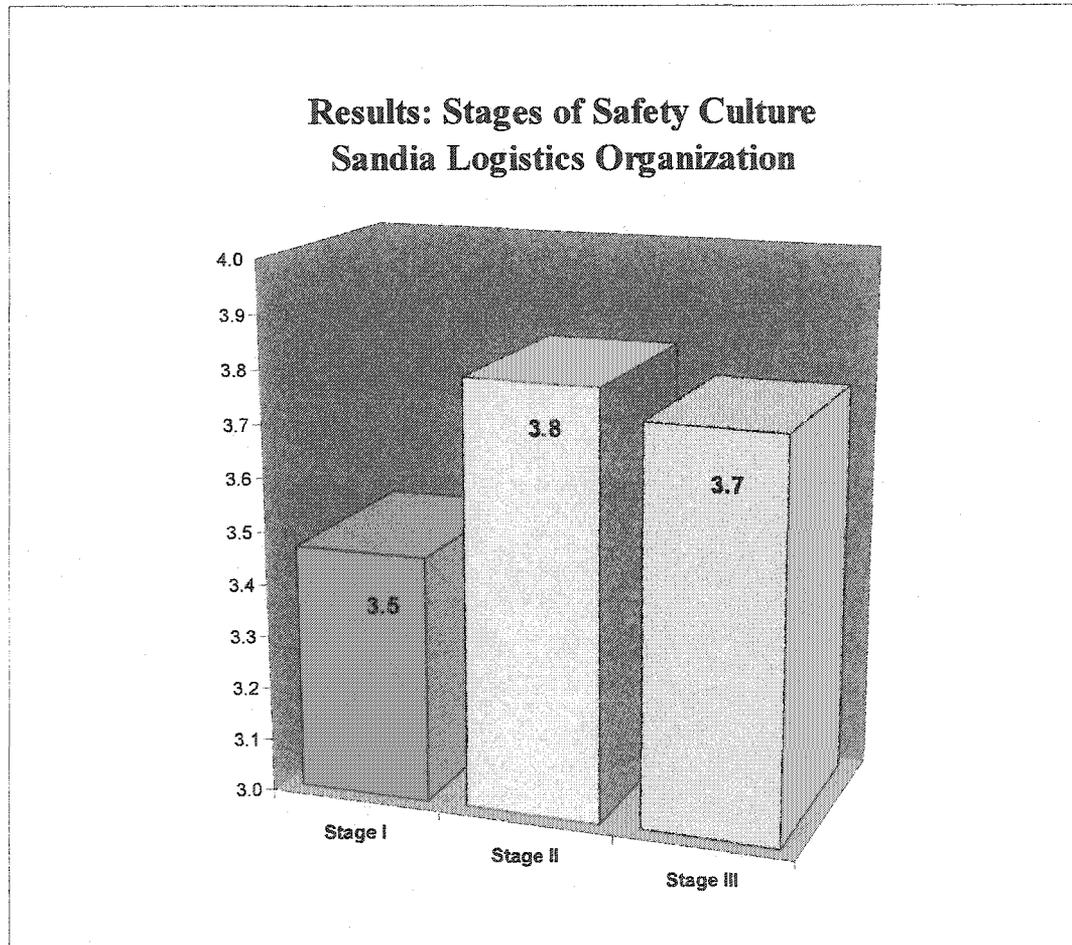
Comment Results

Open-ended comments were collected in the perception survey. Participants were able to comment on any subject regarding safety in the Logistics organization. These comments were captured and are listed in Figure 9: Results: Comments. For an overview of the averages for each statement in the perception survey, refer to Appendix F, Results: Average Score per Survey Statement.

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Figure 9: Results: Comments

COMMENTS
I am unaware of any manager/supervisor formal training.
Logistics and Facilities have a higher accident rate because of the work -- lifting, heavy equipment, etc.
The ES&H Program in Logistics is not as effective as it was 5 years ago.
I think greater communication is needed when an incident happens so that we can all learn from it.
Safety issues need to be addressed on a regular basis by management to employees.
At a previous job it was stressed that "we owned safety." If we saw an unsafe act we were to address it. One thing I've noticed that is disgusting is all the cords under desks. There are steps that can be taken to keep those out of harm's way.
Logistics is an operational, hands-on organization. While accidents and injuries are never a good thing, some are probably not a total surprise. I was not aware Logistics still had a formal "Safety Program" any longer. We seem to handle safety awareness in cycles -- big issue, no issue. Has the flavor of the Program "du jour."

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CHAPTER 5
SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The purpose of the research was to assess management perception of the current

safety culture in the Logistics organization at Sandia National Laboratories. An approval

was obtained from Central Missouri Sate University Graduate School to conduct a human

research study. Refer to Appendix E, Approval from Human Subjects Review

Committee, to view a copy of the approval letter from the Graduate School. The survey

was administered via a perception questionnaire to the total population of Logistics

management comprised of managers, supervisors and staff employees that provide

direction and guidance to line personnel. The perception instrument included an

informed consent form and a two-page survey with 30 statements to measure Logistics

management perception. One open-ended comment section was provided at the end of

the instrument. The survey statements were scored on the Likert scale with five possible

choices on a 1 to 5 scale: 5-strongly agree, 4-agree, 3-uncertain, 2-disagree, 1-strongly

disagree. The subjects were instructed to circle the number that best signified their

perception to the statement. A percentage of 86.6% of the entire population of Logistics

management completed the survey.

The survey was designed to analyze two different criteria: management practices

and the maturity or stage of safety culture. Survey statements were cross-referenced and

linked to the management practice elements the various stages of safety culture. Refer to

Appendix D, Survey Perception Questionnaire Correlation to Management Practice and

Safety Culture Stages, for a chart that correlates the survey instrument statements to the

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criteria analyzed. The survey was professionally validated by an Independent Surveillance Assessment Engineer in the Human Factors and Reliability organization at Sandia National Laboratories for readability and modifications and suggested changes were made to several of the survey statements. The changes were incorporated into the final design of the survey instrument.

The perception questionnaire was reviewed by an independent professional Surveillance Assessment Engineer in the Human Factors and Reliability organization at Sandia National Laboratories.

Conclusions

The research was established to assess management perception of the current safety culture in Logistics and to answer the following questions:

1. What management practice elements are optimally being performed?

2. What management practice elements are of concern and need improvement?

3. What is the current stage of the safety culture based upon the perceptions of Logistics management?

Based on the data, Logistics management perception indicated that there was only one management practice that was optimal, specifically, management commitment. Of the six management practices, management commitment is the most important key component to optimize in a safety program. Management commitment is the major factor for an organization's safety program to be successful (Vrendenburgh, 2002, p. 263). Management commitment scored an average value of 4.2, indicating a perception that management is sincere in wanting an effective safety program.

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The NIOSH elements of a Safety and Health system indicates that both management leadership (commitment) and employee involvement (worker participation) must work together because one is not effective without the other. The data result in the survey indicated that worker participation scored an average value of 3.8 which is close to being optimally performed. To improve worker participation, more opportunities for management and workers to participate together on common safety goals should be made available. The closeness of the average scores for management commitment and worker participation provides a good foundation for moving towards a world-class safety program as identified by Hansen (1993, March, pp. 19-20).

The lowest average value of the management practices was the reward system, with a 3.2 average value. The reward system element of management practices requires improvement. An effective reward system will reinforce desired behaviors as well as establish a discipline system to deal with undesirable behaviors. The management practice of training resulted in an average value of 3.8 which reflects a perception that training is of concern. Improvement in training such as additional courses, refresher training, or restructure of current training programs is required.

Communication and feedback and having a safety-conscious attitude both scored a 3.6 average value. There is a perception that there is an inherent safe attitude in Logistics management employees. Logistics management does their tasks safely and for the right reasons (McSween, 2003, p. 21). Effective and honest communication between workers and management is vital to develop trust. Feedback is also important. Vrendenburgh points out that "In order to influence safety practices, feedback must be

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provided to the employees that are capable of using it" (Vrendenburgh, 2000, p. 265). Logistics management perceives that communication and feedback needs improvement.

Overall, these six safety management practices individually and collectively contribute to an effective safety management program. The Logistics management perception indicates that management commitment is optimally performed. The five other management practice elements; communication and feedback, training, worker participation, reward system and a safety-conscious attitude, all scored below optimal performance of an average of 4. The average values were not below a 3.2 and therefore are not considered to be severely under performance. This is enlightening news for Logistics. Even the slightest change in these management practices can change the safety culture and move the organization quickly towards optimal safety performance.

The three stages of safety culture each display a different awareness and receptiveness to the effect of human behavior and attitudes on safety. By understanding the current maturity level or stage of safety culture of a company or an organization, a basis can be established to identify changes that will improve long-term safety performance. The perception of Logistics management resulted in an average value of 3.5 for Stage I, 3.8 for Stage II, and 3.7 for Stage III. The highest average score is 3.8, signifying that the current stage of safety culture for Logistics is Stage II. As explained by Carnino (n.d.), a Stage II safety culture is "good safety performance becomes an organization goal" (p. 4). Logistics displays the characteristics of a Stage II safety culture. Appendix A, Characteristics of Stages of Safety Culture, explains in more detail those characteristics identified with each stage of safety culture.

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There is opportunity for improvement in a Stage II safety culture. For example, a characteristic of a Stage II organization is one that concentrates on day to day matters rather than strategizing on long-term goals for safety. On a positive note, a Stage II organization encourages cross-departmental teams and communication and is somewhat open about learning from other companies (Carnino, n.d., p. 4). Safety performance needs to be an organizational goal. The results of the perception survey indicate an average value of 3.7 for a Stage III safety culture. This is only one average value less than a Stage II Safety Culture. The closeness of these values is very positive and demonstrates that Logistics management perceives that the Logistics organization is a blend of Stage II and Stage III safety characteristics. Stage III represents an organization where safety performance can always be improved.

Recommendations

There are seven directional hypothesis identified in this research study. After each hypothesis, a statement accepting or rejecting the hypothesis is provided.

H1:   The average value score of perceptions of the management practice element of management commitment meets or exceeds the optimal average related performance score equivalent to the numerical value of 4 or above on the Likert scale. The first directional hypothesis was supported by the data and accepted.

H2:   The average value score of perceptions of the management practice element of communication and feedback meets or exceeds the optimal average related performance level score equivalent to the numerical value of 4 or above on the Likert scale. The data did not support the second directional hypothesis and was rejected.

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H3: The average value score of perceptions of the management practice element of training meets or exceeds the optimal average related performance level score equivalent to the numerical value of 4 or above on the Likert scale. The data did not support the third directional hypothesis and was rejected.

H4: The average value score of perceptions of the management practice element of worker participation meets or exceeds the optimal average related performance level score equivalent to the numerical value of 4 or above on the Likert scale. The data did not support the forth directional hypothesis and was rejected.

H5: The average value score of perceptions of the management practice element of a reward system meets or exceeds the optimal average related performance level score equivalent to the numerical value of 4 or above on the Likert scale. The data did not support the fifth directional hypothesis and was rejected.

H6: The average value score of perceptions of the management practice element of a safety-conscious attitude meets or exceeds the optimal average related performance level score equivalent to the numerical value of 4 or above on the Likert scale. The data did not support the sixth directional hypothesis and is rejected.

H7: The average value score of management perceptions for the characteristics of the three stages of safety culture results in the categorization of the Logistics safety culture within the Stage II level. The seventh directional hypothesis was supported by the data and accepted.

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Logistics is on the edge of a changing safety culture and is ready to move towards a world class safety program to improve safety performance. Logistics is ready to move from a NORM (Naturally Occurring Reactive Management) level of safety management and towards a world class safety program (Hansen, 1993 March, pp. 19-20). The data reflects that the safety culture as perceived by Logistics management is ready and willing to move forward from a Stage II safety culture towards a Stage III safety culture. The management practice of management commitment is optimally performed and provides a strong base to work from to improve the other elements in a safety program to achieve success. There are several recommendations based on the results of this research:

1. Solicit non-management employee input – Expand the scope of this research to include all levels of employees in Logistics.

2. Educate management – There was a clear message that training did not have a high enough level for optimal performance.

3. Implement a reward system – The perception of Logistics management indicates that improvement is needed and a reward system is valued as an important element of a safety program.

4. Continue management commitment – Encourage and practice management commitment with all employee levels for safety performance. Assure adequate budget is provided to implement changes to continue trust relationships.

5. Improve communication and feedback – Explore various methodologies to improve communication between management as well as with all employees regarding safety successes and failures.

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6. Enlist worker participation – Communicate with workers of all levels to develop opportunities for workers to be part of the safety process.

7. Encourage a safety-conscious attitude – Consider expanding the work safety program to include home safety topics to encourage workers to have a good safety attitude both at work and at home.

8. Benchmark – Management should benchmark with world class organizations that have optimal safety programs to gather ideas for continuous improvement.

9. Communicate the results – During a Logistics wide meeting, share the research and survey results with all levels of employees. Review the comments from the survey and be open-minded for opportunities for improvement.

This measurement of management practices and the stage of safety culture in Sandia Logistics identified desirable adjustments for improvement towards a world class safety culture. Logistics management should capitalize on these improvements and focus on the specific characteristics of a Stage III world class safety culture to best leverage the results of this study. In a year, Logistics should perform a follow-up survey utilizing the same measurement instrument to evaluate management practices and the stage of safety culture. Additional studies could be conducted with similar organizations within or outside of Sandia National Laboratories for comparative data. By implementing the recommendations outlined in this research, Sandia Logistics management will positively impact the safety culture in Sandia Logistics which will lead towards an improvement in safety performance in Logistics.

REFERENCES

Carnino, A. (n.d.). Management of safety, safety culture and self assessment.

International Atomic Energy Agency, Division of Nuclear Installation Safety.

Retrieved on July 25, 2004 from

http://www.iaea.or.at/ns/nusafe/publish/papers/mng_safe.htm

Cooper, M.. (2000). Towards a model of safety culture. Safety Science, vol. 36, pp 111-

136. Retrieved July 25, 2004, from http://behavioral-

safety.com/articles/Towards_A_Model_Of_Safety_Culture/

Cooper, D. (1998). Improving safety culture, a practical guide. John Wiley & Sons,

West Sussex, England.

Coyle, J., Bardi, E., & Novack, R. (2000). Transportation. South-Western College

Publishing, Cincinnati, OH.

DeJoy, D., Schaffer, B., Wilson, M., Vandenberg, R., & Butts, M. (2003, September 24).

Creating safer workplaces: Assessing the determinants and role of safety climate.

Journal of Safety Research, National Safety Council. pp. 81 – 90.

Department of Health and Human Services, Centers for Disease Control and Prevention,

National Institute for Occupational Safety and Health (NIOSH). (2004, March).

How to Evaluate Safety and Health Changes in the workplace, Does it Really

Work? DHHS (NIOSH) Publication No. 2004-135. Retrieved July 25, 2004 from

http://www.cdc.gov/niosh/docs/2004-

135/stepsEvaluatingChange/collectData.html

Geller, E. (1996). *The psychology of safety, how to improve behaviors and attitudes on the job.* Chilton Book Company, Radnor, PA.

Hansen, L. (1993, March). Safety management: A call for (r)evolution. *American Society of Safety Engineers, Professional Safety.* pp. 16-21. Retrieved July 10, 2004 from http://www.12hsos.com/publications/index.htm

Hansen, L. (1993, September). Speaking out beyond commitment. Reprinted from *Occupational Hazards.* Retrieved July 10, 2004 from http://www.12hsos.com/publications/index.htm

Krause, T., & Hidley, J. (2003, February). Senior leader in safety. *Industrial Safety and Hygiene News.* BNP Media II, Troy, MI.

Laing, P. [Ed.]. (1992). *Accident prevention manual for business & industry, engineering & technology.* National Safety Council, Chicago, IL.

McSween, T. (2003). *Value-based safety process, improving your safety culture with behavior-based safety.* John Wiley & Sons, Hoboken, NJ.

Petersen, D. (1996). *Safety by objectives.* Von Nostrand Reinhold, Thomson Publishing, Inc. New York, NY.

Pope, W. (1990). *Managing for performance perfection, the changing emphasis.* Bonnie Brae Publications, Weaverville, NC.

Robson, L., Shannon, H., Goldenhar, L., & Hale, A. (2001, April). *Guide to evaluating the effectiveness of strategies for preventing work injuries: How to show whether a safety intervention really works.* Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health (NIOSH), Washington, D.C.

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Safety & Health Management Systems eTool. (2004). Occupational Safety & Health

Administration (OSHA), U.S. Department of Labor, Washington, D.C. Retrieved

July 20, 2004 from http://www.osha.gov/SLTC/etools/safetyhealth/comp1.html

Sarkus, D. (2001, January). Safety and psychology, where do we go from here?

American Society of Safety Engineers, Professional Safety. pp. 18-25.

Souter, G. (1997). *Safety requires skillful management.* Reprinted from Business

Insurance, issue of April 21, 1997, p. B1. Crain Communications.

Toellner, J. (2001, September). Improving safety & health performance: Identifying &

measuring leading indicators. *American Society of Safety Engineers, Professional*

Safety. pp. 42-47.

Tompkins, J., White, J., Bozer, Y., Frazelle, E., Tanchoco, J., & Trevino, J. (1996).

Facilities planning. John Wiley & Sons, New York, NY.

U. S. Department of Transportation, Research and Special Programs Administration.

Title 49, Code of Federal Regulations, Transportation. Parts §171 through §180.

Vredenburgh, A. (2002, December 6). Organizational safety: Which management

practices are most effective in reducing employee injury rates? *Journal of Safety*

Research, vol. 33, pp. 259-276.

APPENDIX A
CHARACTERISTICS OF STAGES OF SAFETY CULTURE

Reference: Carnino, Annick. (n.d.). Management of Safety, Safety Culture and Self Assessment. *International Atomic Energy Agency, Division of Nuclear Installation Safety.* Retrieved on July 25, 2004 from http://www.iaea.or.at/ns/nusafe/publish/papers/mng_safe.htm

Stage I: Safety Solely Based on Rules and Regulations

- Problems are not anticipated; the organization reacts to them as they occur.
- Communication between departments and functions is poor.
- Departments and functions behave as semi-autonomous units and there is little collaboration and shared decision-taking among them.
- The decisions taken by department and functions concentrate upon little more than the need to comply with rule.
- People who make mistakes are simply blamed for their failure to comply with the rules.
- Conflicts are not resolved; departments and functions compete with one another.
- The role of management is seen as endorsing the rules, pushing employees and expecting results.
- There is not much listening or leaning inside or outside the organization which adopts a defensive posture when criticized.
- Safety is viewed as a required nuisance.
- Regulators, customers, suppliers and contractors are treated cautiously or in an adversarial manner.
- Short term profits are seen as all important.
- People are viewed as 'system components; - they are defined and valued solely in terms of what they do.
- There is an adversarial relationship between management and employees.
- There is little or no awareness of work, or business, processes.
- People are rewarded for obedience and results, regardless of long term consequences.

Stage II: Good Safety Performance Becomes an Organizational Goal

- The organization concentrates primarily on day to day matters; there is little in the way of strategy.
- Management encourages cross-departmental and cross-functional teams and communication.
- Senior managers function as a team and begin to co-ordinate departmental and functional decision.
- Decisions are often centered around cost and function.
- Management's response to mistakes is to put more controls, via procedures and retraining, in place. There is little blaming.

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Stage II: Good Safety Performance Becomes an Organizational Goal
Continued

- Conflict is disturbing and discouraged in the name of teamwork.
- The role of management is seen as applying management techniques, such as management by objectives.
- The organization is somewhat open about learning from other companies, especially techniques and best practices.
- Safety, cost and productivity are seen as detracting from one another. People think that safety means higher cost and reduced production.
- The organization's relationship with regulators, customers, suppliers and contractors is distant rather than close; this is a cautious approach where trust has to be earned.
- It is important to meet or exceed short-term profit goals. People are rewarded for exceeding goals regardless of the long-term results or consequences.
- The relationship between employees and management is adversarial, with little trust or respect demonstrated.
- There is a growing awareness of the impact of cultural issues in the workplace. People do not understand why added controls do not yield the expected results in safety performance.

Stage III: Safety Performance Can Always Be Improved

- The organization begins to act strategically with a focus on the longer term as well as an awareness of the present. It anticipates problems and deals with their causes before they happen.
- People recognize and state the need for collaboration among departments and functions. They receive management support, recognition and the resources they need for collaborative work.
- People are aware of work, or business, processes in the company and help managers to manage them.
- Decisions are made in the full knowledge of their safety impact on work, or business, processes as well as on departments and functions.
- There is no goal conflict between safety and production performance, so safety is not jeopardized in the pursuit of production targets.
- Almost all mistakes are viewed in terms of work process variability. The important thing is to understand what has happened rather than find someone to blame. This understanding is used to modify the process.
- The existence of conflict is recognized and dealt with by trying to find mutually beneficial solutions.
- Management's role is seen as coaching people to improve business performance.
- Learning from others both inside and outside the organization is valued. Time is made available and devoted to adapting such knowledge to improve business performance.

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Stage III: Safety Performance Can Always Be Improved
continued

- Safety and production are seen as inter-dependent.
- Collaborative relationships are developed between the organization and regulators, suppliers, customers and contractors.
- Short term performance is measured and analyzed so that changes can be made which improve long-term performance.
- People are respected and valued for their contribution.
- The relationship between management and employees is respectful and supportive.
- Aware of the impact of cultural issues and these are factors considered in key decisions.
- The organization rewards not just those who 'produce' but also those who support the work of others. Also, people are rewarded for improving processes as well as results.

APPENDIX B
INTEGRATED SAFETY MANAGEMENT SYSTEM (ISMS)

Sandia National Laboratories consists of facilities (buildings, equipment, structures) that are owned by the U. S. Department of Energy (DOE). Sandia is committed to performing work safely and ensuring the protection of Members of the Workforce, the public, and the environment. Sandia is also committed to performing work effectively and efficiently through implementation of the ISMS Program. Sandia expects to achieve improved safety performance and a consistent set of safety policies, objectives, principles, and management functions.

The Integrated Safety Management System is a model for implementing ES&H at Sandia. Through this system Sandia is applying good business practices to ensure that work is performed safely and that ES&H is considered throughout all stages of work, from planning to performance to improvement. Through ISMS, Sandia is trying to accomplish the following:

- Make work safe for workers, the public, and the environment.

- Ensure that line organizations take responsibility for ES&H (i.e., the person responsible for project success is responsible for ES&H).

- Integrate existing and new ES&H processes and practices into an easily understood, manageable system.

- Increase consistency at SNL, yet tailor to the needs of individual organizations.

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There are five core safety management functions that provide the necessary structure for any work activity that could potentially affect the public, the workers, and the environment. The functions are applied as a continuous cycle with the degree of rigor appropriate to address the type of work activity and the hazards involved. The figure below shows the ISMS star, which is Sandia's graphical depiction of the five safety management functions.

Integrated Safety
Management
System (ISMS)

Safety Management Functions:

1. Plan Work

- Develop and maintain work plans to meet mission.
- Communicate management expectations (policy, standards, goals, performance objectives).
- Establish organization structure, interfaces, roles and responsibilities, authorities, and ownership.
- Manage resources (e.g., staff budget prioritization process).

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2. Analyze Hazards

- Identify hazards
- Categorize hazards
- Classify facilities, activities, projects
- Define authorization basis

3. Control Hazards

- Identify standards and requirements
- Establish controls to prevent or mitigate hazards (engineering, administrative, PPE)
- Implement work control prerequisites

4. Perform Work

- Confirm operation readiness
- Work within operational limits
- Know how to respond in an emergency
- Document daily operations

5. Feedback and Improve

- Gather feedback from employees and customers
- Share lessons learned/operating experiences
- Conduct management site visits/surveillances
- Perform self-assessments
- Conduct external audits

ISMS Implementation

Because of the broad scope of Sandia operations, the formality and rigor of ISMS are tailored to the nature of the work and the associated hazards. Corporate requirement documents state what shall be done. Individual organizations determine how to implement those requirements in their work processes and procedures. Complete implementation of Sandia's ISMS includes customization and implementation of mechanisms within every division. There are several corporate coordinating safety teams that assist the line organization in an advisory capacity.

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Per Sandia Environment, Safety and Health Policy number CPS400.1, Sandia line management is responsible and accountable for implementing ISMS and for conducting work in a manner that ensures protection of Members of the Workforce, the public, and the environment. The term "Sandia Line Management" means the chain of organizational management (as opposed to project management) responsibility and accountability as follows:

1. President
2. Executive Vice President
3. Vice Presidents
4. Directors
5. Level II Managers (Deputy Directors)
6. Department Managers
7. Team Supervisors

With regard to ISMS, department managers have primary responsibility for the health and safety of the personnel they direct. They, along with the team supervisors, are accountable for the following:

- Holding their personnel accountable for meeting ES&H requirements.

- Ensuring that hazard controls are in place (e.g., training or medical surveillance requirements).

- Preventing employees from working at sites that are not properly equipped or on activities or with hazards for which they are not qualified or have not completed the required training.

- Maintaining appropriate ES&H documents and procedures.

- Being familiar with the activities and physical work sites of their employees.

- Addressing ES&H concerns promptly and effectively.

Workers need to understand how the five safety management functions of ISMS are applied to the work they do and participate in the development of safe work practices.

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Workers are also responsible for working safely, complying with procedures and requirements, and exercising their right and responsibility to not participate in and to stop work in any unsafe operation (until the operation has been determined to be safe).

It is recommended that individual department organize their current practices into the five safety management functions. To make sure work is performed safely; department managers or team supervisors should periodically evaluate activities and check that the safety management functions are being followed. Documents may need to be revised; controls or practices may need to be developed if they are not adequately addressing the five functions. Through the ISMS concept, Sandia is renewing emphasis on the following:

- Clearly defining roles and responsibilities.

- Identifying, analyzing, and updating all hazards and controls.

- Using lessons learned to prevent problems.

- Performing self-assessments and making improvements.

The Integrated Safety Management System (ISMS) systematically integrates safety into management and work practices at all levels so that missions are accomplished while protecting the worker, the public, and the environment.

APPENDIX C
INFORMED CONSENT AND
SAFETY PERCEPTION SURVEY QUESTIONNAIRE

Dear Survey Participant,

Your participation in a survey about safety culture in the Sandia National Laboratories Logistics Organization is requested. A student at Central Missouri State University, who is also a current employee in Logistics, has developed the survey. This perception questionnaire is being conducted as a partial requirement for graduation from Central Missouri State University to complete a Master of Science Degree in Occupational Industrial Safety. This survey is being conducted to study and document management perceptions of the Logistics Organization safety culture. Management includes managers, supervisors and staff personnel.

All persons involved in completing this questionnaire will remain anonymous and are participating on their free will. Your participation in this study is voluntary. The amount of time estimated to complete the survey is fifteen (15) minutes. Please do not write your name on this questionnaire. Information collected from this questionnaire is strictly confidential and will not be traced to any individual or their associated department. If you decide to participate, you are free to stop participation at any time with no penalty to you. The completion of this survey means you are consenting to the use of the information you provide.

You will be asked to read questions and circle a number corresponding to your perception. There are no anticipated risks associated with answering the survey questions. The results of this survey will be tabulated, scored, and compiled by an Independent Surveillance Assessment Engineer in Organization 12337 and assembled into a final report which will be used in the planning of any improvement initiatives. After the survey results are documented, the survey forms will be destroyed to ensure complete confidentiality. If you choose to receive information regarding the results of this survey, please contact the division 10000 Environmental, Health and Safety Representative Professional, Brad Lackey.

If you have any questions about your rights as a research subject, you can contact the Office of Sponsored Programs, Central Missouri State University, Ward Edwards 1800, Warrensburg, MO 64093, or call (660) 543-4264, or go online to www.cmsu.edu/research.

Your response is highly valued and will be very much appreciated.

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SAFETY CULTURE SURVEY QUESTIONNAIRE

Your participation in the survey is voluntary and will remain anonymous. All survey results are strictly confidential and individual survey forms will not be shared with management. All answers will be pooled and the overall response to the question will be recorded.

Directions: Please do not place your name on the survey sheet. Answer the questions as honestly as possible and respond to each question.

	Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree
Management clearly wants a safe working environment.	5	4	3	2	1
Management acts upon employee input to safety issues.	5	4	3	2	1
The proper tools and equipment are available to complete the job safely.	5	4	3	2	1
I remember clearly the last time a Manager or Supervisor personally did something important to encourage safety in Logistics.	5	4	3	2	1
Management is committed to safety.	5	4	3	2	1
Management effectively communicates safety issues.	5	4	3	2	1
I am aware of the results of regular safety inspections from my Supervisor or Manager.	5	4	3	2	1
Unsafe acts and conditions represent the basic cause of accidents in Logistics.	5	4	3	2	1
Supervisors and Managers discuss the safety record and safety incidents with employees.	5	4	3	2	1
My immediate Manager or Supervisor discusses safety in staff or team meetings.	5	4	3	2	1
Supervisors and Managers have adequate training in ES&H.	5	4	3	2	1
Division 10000 ES&H representative is available to answer my questions.	5	4	3	2	1
Managers and Supervisors have received formal training in safety and health management responsibilities.	5	4	3	2	1
I understand the Sandia ES&H procedures.	5	4	3	2	1

Please turn to next page.

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	Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree
If I am not sure about a safety rule or regulation, someone is available to explain it to me.	5	4	3	2	1
Employees are more productive when they know management is looking out for their general well-being.	5	4	3	2	1
I regularly attend safety meetings or briefings.	5	4	3	2	1
Employees have ownership of safety and health.	5	4	3	2	1
Management encourages you to interact when you see unsafe behavior.	5	4	3	2	1
Employees feel like they are a real part of the Logistics Safety Program.	5	4	3	2	1
Safety rules are applied in a consistent manner by all Supervisors.	5	4	3	2	1
Safety performance is included in my performance evaluation.	5	4	3	2	1
Safety enforcement should be more strict.	5	4	3	2	1
Employees are given positive feedback when they perform work safely.	5	4	3	2	1
The accident and incident frequency is the only way to measure safety performance.	5	4	3	2	1
Safety is never compromised for the sake of getting the job done.	5	4	3	2	1
The Logistics Safety Program has increased my off-the-job safety.	5	4	3	2	1
Regular safety inspections are performed by Supervisors and/or Managers.	5	4	3	2	1
The Logistics ES&H Program is effective.	5	4	3	2	1
I feel safe while performing my job.	5	4	3	2	1

Comments:

Thank You for Your Responses!

APPENDIX D
SURVEY PERCEPTION QUESTIONNAIRE CORRELATION TO
MANAGEMENT PRACTICES AND SAFETY CULTURE STAGES

The perception survey is designed to address both management practices and the stages of safety culture. These charts depict the correlation between the survey statements and the management practices and safety culture stages.

Management Practice:

MC	Management Commitment	Survey Statements 1, 2, 3, 4, 5
CF	Communication and Feedback	Survey Statements 6, 7, 8, 9, 10
TR	Training	Survey Statements 11, 12, 13, 14, 15
WP	Worker Participation	Survey Statements 16, 17, 18, 19, 20
RS	Reward System	Survey Statements 21, 22, 23, 24, 25
SC	Safety-Conscious Attitude	Survey Statements 26, 27, 28, 29, 30

Safety Culture Stages (Refer to Appendix A, Characteristics of Safety Culture)

I	Safety Solely Based on Rules and Regulations	Survey Statements 8, 11, 12, 13, 14, 17, 23, 25, 26, 28
II	Good Safety Performance Becomes an Organizational Goal	Survey Statements 1, 3, 4, 5, 6, 7, 9, 10, 15, 29
III	Safety Performance Can Always Be Improved	Survey Statements 2, 16, 18, 19, 20, 21, 22, 24, 27, 30

	Survey Statement	Management Practice	Safety Culture
1.	Management clearly wants a safe working environment.	MC	II
2.	Management acts upon employee input to safety issues.	MC	III
3.	The proper tools and equipment are available to complete the job safely.	MC	II
4.	I remember clearly the last time a Manager or Supervisor personally did something important to encourage safety in Logistics.	MC	II
5.	Management is committed to safety.	MC	II
6.	Management effectively communicates safety issues.	CF	II
7.	I am aware of the results of regular safety inspections from my Supervisor or Manager.	CF	II
8.	Unsafe acts and conditions represent the basic cause of accidents in Logistics.	CF	I
9.	Supervisors and Managers discuss the safety record and safety incidents with employees.	CF	II

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	Survey Statement	Management Practice	Safety Culture
10.	My immediate Manager or Supervisor discusses safety in staff or team meetings.	CF	II
11.	Supervisors and Managers have adequate training in ES&H.	TR	I
12.	Division 10000 ES&H representative is available to answer my questions.	TR	I
13.	Managers and Supervisors have received formal training in safety and health management responsibilities.	TR	I
14.	I understand the Sandia ES&H procedures.	TR	I
15.	If I am not sure about a safety rule or regulation, someone is available to explain it to me.	TR	II
16.	Employees are more productive when they know management is looking out for their general well-being.	WP	III
17.	I regularly attend safety meetings or briefings.	WP	I
18.	Employees have ownership of safety and health.	WP	III
19.	Management encourages you to interact when you see unsafe behavior.	WP	III
20.	Employees feel like they are a real part of the Logistics Safety Program.	WP	III
21.	Safety rules are applied in a consistent manner by all Supervisors.	RS	III
22.	Safety performance is included in my performance evaluation.	RS	III
23.	Safety enforcement should be more strict.	RS	I
24.	Employees are given positive feedback when they perform work safely.	RS	III
25.	The accident and incident frequency is the only way to measure safety performance.	RS	I
26.	Safety is never compromised for the sake of getting the job done.	SC	I
27.	The Logistics Safety Program has increased my off-the-job safety.	SC	III
28.	Regular safety inspections are performed by Supervisors and/or Managers.	SC	I
29.	The Logistics ES&H Program is effective.	SC	II
30.	I feel safe while performing my job.	SC	III

Central

MISSOURI STATE UNIVERSITY

November 2, 2004

CYNTHIA KAJDER
SANDIA NATIONAL LABORATORIES
P.O BOX 5800, MAILSTOP 1120
ALBUQUERQUE NM 87185

Dear Ms. Kajder,

Your research project, "Management Perceptions of the Safety Culture in Logistics at Sandia National Laboratories" was approved by the Human Subjects Review Committee on November 2, 2004. This approval is valid through November 2, 2005.

Please note that you are required to notify the committee in writing of any changes in your research project and that you may not implement changes without prior approval of the committee. You must also notify the committee in writing of any change in the nature or the status of the risks of participating in this research project.

Should any adverse events occur in the course of your research (such as harm to a research participant), you must notify the committee in writing immediately. In the case of any adverse event, you are required to stop the research immediately unless stopping the research would cause more harm to the participants than continuing with it.

At the conclusion of your project, you will need to submit a completed Project Status Form to this office. You must also submit the Project Status Form if you wish to continue your research project beyond its initial expiration date.

If you have any questions, please feel free to contact me at the number above.

Sincerely,

David S. Kreiner, Ph.D.
Assistant Dean of The Graduate School
kreiner@cmsu1.cmsu.edu

pc: Omer, Frank, Hum, 329D

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Results: Averages for Individual Survey Statements
Sandia Logistics Organization
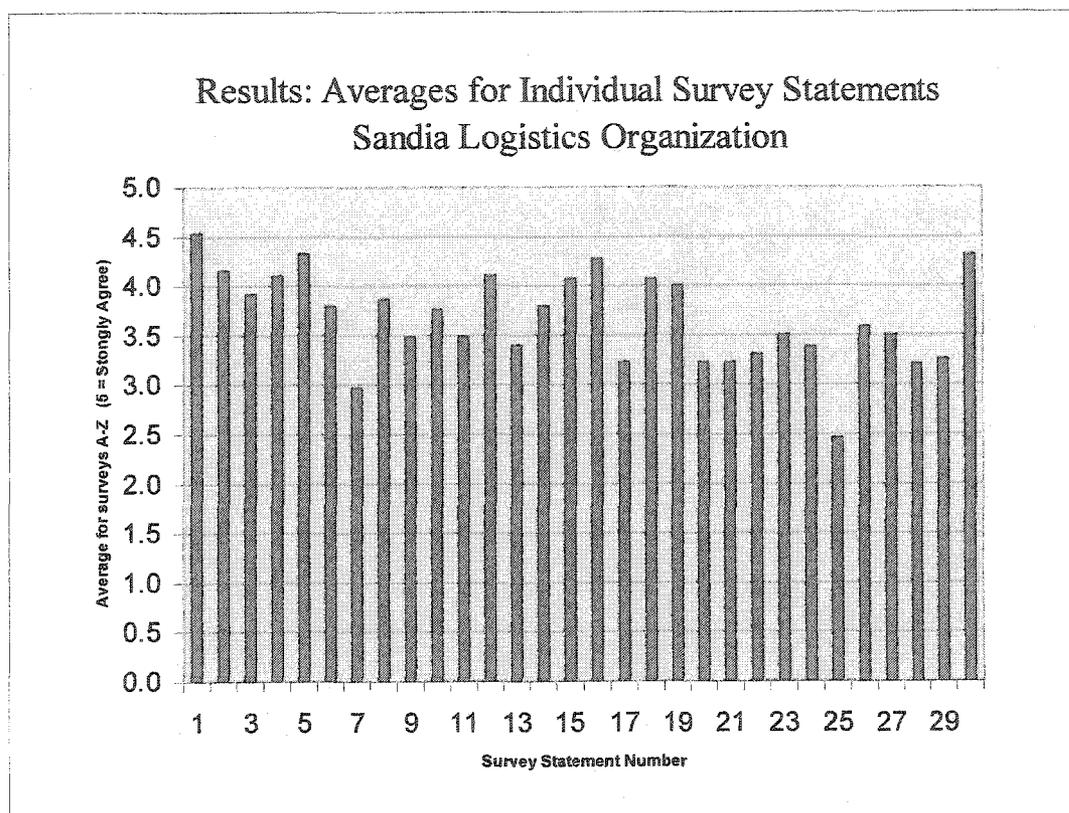
Refer to Appendix D, Survey Perception Questionnaire Correlation to Management
Practices and Safety Culture Stages for a numerical listing for each survey statement.

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