DISSERTATION

ASSESSING SAFETY CULTURE, VALUES, PRACTICES, AND OUTCOMES

Submitted by

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WE HEREBY RECOMMEND THAT THE DISSERTATION PREPARED UNDER OUR SUPERVISION BY EVERON CHRISTINA CHENHALL ENTITLED ASSESSING SAFETY CULTURE, VALUES, PRACTICES, AND OUTCOMES BE ACCEPTED AS FULFILLING IN PART REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY.

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ABSTRACT OF DISSERTATION

ASSESSING SAFETY CULTURE, VALUES, PRACTICES, AND OUTCOMES

The purpose of this study was to identify where safety performance improvements can be made, thus establishing a foundation for further study by the company to formulate specific recommendations within the identified areas. The data were analyzed to determine whether five organizational practices and values described herein were predictors of 2009 safety performance. Accordingly, this non-experimental comparative study examined differences in safety culture dimensions between plants that achieved and failed to achieve their 2009 safety goals. The Competing Values Framework (Quinn & Kimberly, 1984) was adapted to assess safety culture strengths and congruencies among plants as an extension of the work of Silva, Lima, and Baptista (Isla Díaz & Díaz Cabrera, 1997, p. 643; 2004, p. 643) and Díaz-Cabrera (2007). Additionally, the underlying values, leadership types, and culture orientations measured through the *Questionnaire of Safety Culture Values and Practices* were tested for the first time as predictors of accident data. Despite considerable research on safety climate and culture predictors of accidents in organizations (Clarke, 2006), "the practical significance of these factors in the prevention of accidents remains undetermined" (Isla Díaz & Díaz Cabrera, 1997, p.643).

The researcher analyzed the combination of the difference and associational research questions. Exploration of the first research question involved analyzing the differences among the plants based on the results of the One-Way ANOVA for the five safety culture

values and practices scores. Research question two was subdivided into three questions to clarify the three safety performance indicators (OSHA, LTA, and severity). The results of the independent *t*-tests compared the safety culture values and practices scores across the plants that achieved and failed to achieve 2009 safety goals for Occupational Safety Health Administration (OSHA) incident rates, Lost Time Away (LTA), and severity.

Additionally, the five safety culture values and practices scores were compared across geographic regions for research question three. Finally, regression was run to determine if a combination of the safety culture values and practices scores were predictive of 2009 OSHA, LTA, and severity rates. Research question five was subdivided into three questions regarding differences on the safety culture type. To answer the three research questions, *t*-tests were conducted to examine differences among the plants' three safety outcomes and the plants' averages for each of the four safety culture types.

Neither safety culture type scores nor safety culture values and practices scores were predictors of 2009 OSHA, LTA, or severity rates. The *t*-test results indicated large effects on a) company values, b) communication, c) and usage of accident information between the four plants that did and did not achieve 2009 LTA and severity goals, despite non-significant results. Differences among the plants were noted and analyzed for trends.

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DEDICATION

To my dearly loved mother, father, and brother who have supported and encouraged me throughout my journey and always been there for me; to my amazing colleagues and friends at Colorado State University and at FBC Fort Collins who encouraged and prayed for me; to Jim who had a significant part in the development of the study; and especially to my Lord, and my Savior Jesus Christ, who worked out all the details of my dissertation, I humbly dedicate this study.

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My co-advisor, Dr. Alina M. Waite, has been a devoted mentor, friend, and encourager who worked closely with me throughout each stage of my dissertation! She was always interested in the latest developments of my study. She provided thorough and detailed feedback regarding suggestions for structuring the study and developing process diagrams. She invested a tremendous amount of time in my study and in my professional

growth. I will never forget when we worked at the library until midnight and the lights were nearly turned out on us!

My methodologist, Dr. Gene Gloeckner, encouraged me and guided me throughout the study! He was involved in the initial communication with the company. He provided practical insights into designing and conducting the study. His recommendations for the data analysis were fantastic. I certainly appreciated his feedback and timely responses to my questions. He was very approachable and met with me regularly to discuss research strategies. His proposal development course was most helpful!

I also want to thank Dr. Tom Chermack for serving on my committee and making EFA suggestions. I sincerely appreciate Dr. Christine Henle for joining my committee, advising me on the selection of study variables, providing helpful edits, and allowing her GRA to assist with data entry. Drs. Lumina Albert and Rosemond Desir met with me to discuss the study design and the uniqueness of this study. Dr. Albert also provided the opportunity to guest lecture in her management course. Drs. zumBrunnen and Morgan provided statistical assistance. Ian Gordon provided assistance with formatting the dissertation. A couple of graduate students entered survey data. Kathy Lucas was an excellent resource in the graduate programs office. I want to express my most sincere appreciation to all who had a part in my dissertation study.

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CHAPTER ONE-INTRODUCTION AND BACKGROUND

DuPont, a multinational chemical corporation and nationally recognized leader in state-of-the-art safety interventions, asserts that "all injuries and occupational illnesses can be prevented" (Dupont, 1994, p. 1.2). The accepted practice is that there is no such thing as an "accident." DuPont's proactive safety management philosophy is driven by decades of culture emphasis on safety management, which has historically been actively embraced and empowered by the most senior levels of company management. In recognition of its widely acclaimed role in safety leadership, DuPont received the Excellence in Safety Training Award from Workplace HR & Safety magazine in 2007 (DuPont, 2007). Another major chemical corporation, 3-M, places emphasis on standardizing and enforcing safety policies and procedures at all plants worldwide, even off shore plants, where government mandated safety requirements are absent or unenforced.

Case studies and literature reviews (Boin & Schulman, 2008; Chang & Liang, 2009; Findley, Smith, Gorski, & O'Neil, 2007; Robson et al., 2007) featured multiple organizations that have also followed suit and demonstrated a commitment to occupational health and safety programs and projects. During the exploratory phase of this study, the researcher investigated anomalies in potential predictors of safety performance. Some of the anomalies among organizations included clearly articulated methodologies for assessing safety hazards, regular audits, key safety interventions, and required employee and management training.

Policy and regulatory requirements have an acknowledged impact on safety performance, but excellence can only be achieved by factoring purposeful interventions into the organizational culture. Therefore, is it possible to connect methodologies of safety management to the organizational culture?

Simon and Cistaro (2009) claimed that "safety excellence is a product not only of the right programs…but also of the right culture" (p.30). They proceeded to describe how safety is analogous to a stew with broth.

> "Safety programs are the ingredients in the stew-policies, systems and processes as the meat and vegetables, while the prevailing culture is the broth. If the ingredients are cooking in a wholesome broth-a positive safety culture of trust, caring, responsible leadership-everything works to its potential." (p. 30)

Approached from the disciplines of organizational performance and change and occupational health and safety, this study was designed to analyze the perceptions of values and organizational practices related to safety culture. This exploratory study was performed in an undisclosed company consisting of 19 plants with similar operations throughout the United States and Canada. For feasibility purposes, this study included eight plants. This study was designed to ensure that plants within distinct regions of the United States were included to account for any variances that might be attributable to geographic location.

This study will be based on the models representing four types of safety culture as follows: the Human Relations (Support), Open Systems (Innovation), Internal Processes (Policies), and Rational Goals (Goals). Dimensions of five organizational practices and values are presented in association with each of the safety culture models from the work

of Díaz-Cabrera, Hernández-Fernaud, and Isla-Díaz (2007) and adapted from Cameron and Quinn's (Cameron & Quinn, 1999, 2006) Competing Values Framework (Cameron & Quinn, 1999, 2006). The Competing Values Framework classifies the values, practices, and leadership styles according to culture type. Culture types are presented along a continuum according to whether the organization has an internal or external focus and whether the organization is typified by stability and control or by flexibility and discretion (Cameron & Quinn, 1999, 2006).

Research Problem

The research literature discusses several approaches to developing a positive safety culture. However, most of the research does not classify types of positive safety culture according to the culture dimensions specific to both values and organizational practices. Despite multiple attempts to explain safety culture through competing models, there is limited empirical research to substantiate which company values and organizational safety practices have the most demonstrative impact on safety performance at the plant level.

Purpose

The purpose of this study was to prevent workplace injuries and lost time through improved organizational safety practices in an undisclosed company. Accordingly, this study examined differences in safety culture dimensions between plants that achieved and failed to achieve their 2009 safety goals. The safety culture dimensions of the five organizational values and practices were examined in relation to Occupational Safely and Health Administration (OSHA), Lost Time Away (LTA), and severity rates.

Research Questions

The following overarching research questions were formulated from the work of Díaz-Cabrera et al. (2007), the Competing Values Framework (Cameron & Quinn, 1999, 2006), and discussions with the organization's safety management team. Research questions were developed to study which combination of safety culture type scores, for each of the five organizational practices and values, predict safety performance by plant in the undisclosed organization. The criteria or dependent variables were the safety performance measures, whereas the predictors or independent variables were the culture type scores representative of the dimensions of organizational practices and values.

1. Are there differences among the eight plants based on the average of the summated safety culture values and practices scores?
2. Are there differences between the plants that achieved and failed to achieve 2009 safety goals in regard to the average of the summated safety culture values and practices scores?
3. Are there differences in the averages of the summated safety culture values and practices scores by geographic region?
4. How well do the individual and combined safety culture values and practices scores predict 2009 plant safety performance?
5. Are there differences between the plants that achieved and plants that failed to achieve 2009 safety goals in regard to the average of the summated safety culture type?

Table 1

Definition of Key Terms

Authors' Definitions of Terms	Term in This Study
Six organizational processes are the characteristics of the four safety culture models adapted from the Competing Values Framework.	The term was modified and referred to the *five organizational practices and values* due to variations in English translation from Spanish and the exclusion of training programs.
Safety culture profile: Diaz-Cabrera's (2007) *Safety culture profile* encompasses the five organizational practices and values and the corresponding four safety culture types	*Safety culture profile:* encompasses the five organizational practices and values and the corresponding four safety culture types
Recordable incident rate defined by OSHA Section 1904.4 as follows: "mathematical calculation that describes the number of employees per 100 full-time employees that have been involved in a recordable injury or illness" Subpart C – Recordkeeping Forms and Recording Criteria (66 FR 6123, Jan. 19, 2001) (OSHA, 2009). Note to Subpart C: This Subpart describes the work-related injuries and illnesses that an employer must enter into the OSHA records and explains the OSHA forms that employers must use to record work-related fatalities, injuries, and illnesses.	*OSHA rates or OSHA recordable rates* (See Appendix A)
Lost time case rate is the "number of lost time cases per 100 full-time employees in any given time frame"(OSHA, 2009).	*LTA rates* (See Appendix B)
Severity rate is "a calculation that gives a company an average of lost days per recordable incident" (OSHA, 2009)	*Severity rates* (See Appendix C)

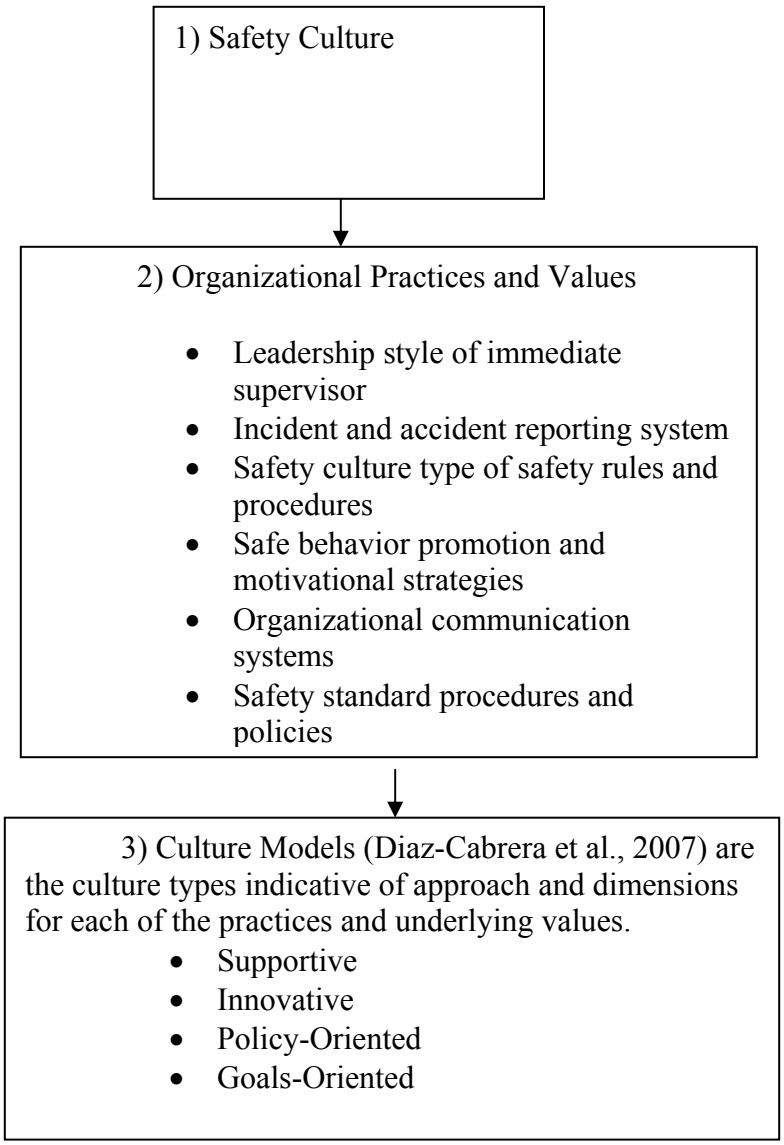

Figure 1. Study Outline

Limitations and Assumptions

Senior management of the undisclosed company invited this researcher to study unexplained variations in safety performance indicators among the four plants classified as those that meet 2009 safety goals and the four that did not achieve the 2009 safety goals. The company selected the eight plants according to OSHA, Lost Time Away (LTA), and severity rates. The company provided the 2009 OSHA recordable rates, LTA, and severity rates. Management also considered geographic region and proprietary information, such as accident related costs, as the basis for inclusion of plants in this study.

This study was not designed for the results to be generalized to other companies; however, the results likely have applications for the other plants within the company with homogeneous operations. A significant limitation is the lack of control the researcher had at each plant. For example, turnover rates and company and job tenure varied by plant and thus impacted this study's validity. Additionally, the assumption was made that respondents were honest and provided meaningful survey responses.

Delimitations

The focus of this study was exclusively on the organizational practices and values associated with employees and managers and their values, beliefs, and perceptions. Furthermore, the Competing Values Framework did not display the linkage between organizational culture and technical systems, such as equipment design and work processes. Therefore, this study did not account for the gaps in the technical systems that might be linked to performance. However, the plants included in this study had essentially the same operations and processes.

The researcher clearly established the following parameters for this study:

1. The organization selected for this study was based on convenience sampling in selecting a single organization.
2. The organization desires to improve safety performance.
3. The plants have similar operations and processes.
4. The organization has some plants that have significant variations in safety performance outcomes, such as recordable incident rates and lost time.
5. This study was limited by data that could be collected via a paper questionnaire.
6. This study is limited to a total of eight plants that did and did not meet the company's 2009 safety goals.
7. The scope of this study is limited to production and maintenance employees and first line supervisors.

Significance of the Study

Research has not confirmed whether the Competing Values Framework can be applied to diagnosing and changing safety culture (Díaz-Cabrera et al., 2007). Accordingly, the results of this study could inform future studies on the predictive validity of the *Safety Culture Values and Practices* instrument by comparing safety culture type scores with safety performance. An understanding of which organizational practices and values have the most demonstrative impact on safety performance can enhance further research on developing the "optimal profile" and model of safety culture (Diaz-Cabrera, 2007, p. 17).

Researcher's Perspective

Based on my work experiences in corporate offices, small businesses, and universities, I have observed a variety of organizational cultures. Witnessing firsthand the impact of culture on behavior, I have noticed new employees' and managers' efforts to conform to acceptable workplace practices. It is difficult to adopt certain practices if they do not align with one's values. I have also noticed how certain work values and beliefs about an organization drove certain behaviors. Some managers and employees had values congruent with the organization, while others did not. Although I could not directly measure the impact of differing values on the organization's overall performance, I sensed the tension in how work was performed, how employees were managed, and how conflicting approaches to adopting new practices were handled. I also experienced the pain of working in organizations where culture change was desperately needed, but did not occur.

Safety is a prime example of a critical organizational component that can be studied in relation to culture as evidenced by leadership and employee behaviors and attitudes, performance management systems, and communications. Leadership style, management, and employee practices are indicative of specific values. A study on safety permitted me to study the relationship between indicators of safety values at various levels of the organization and the corresponding safety performance outcomes. I am viewing the organization in this study as an external consultant to maximize objectivity in analyzing the data. I am willing to be open to whatever I may discover as I study this topic in greater depth.

CHAPTER TWO-LITERATURE REVIEW

As of October 2009, the Bureau of Labor Statistics (BLS) reported that the total workforce in the United States was approximately 154 million (2009b), all of whom are potentially susceptible to injuries on-the-job. Even with stringent Occupational Safety and Health Administration (OSHA) regulations covering virtually all organizations, and not withstanding each individual employer's commitment to safety, on-the-job deaths and injuries occur at alarming rates. Tragically, there were 3.7 million non-fatal injuries in 2008 among all private industry employers. More than 50% of the 3.7 million injuries were serious and involved job transfers or days away from work (BLS, 2009a).

The United States had 14,071 million employees in manufacturing during 2007, of which there were 5.6 total recordable cases of injuries and illnesses per 100 employees (BLS, 2009a). With advances in manufacturing technology including robotics, and considering decades long OSHA requirements and enforcement, why does the manufacturing sector continue to have unacceptably high incident rates according to OSHA standards? After all, safety performance is one of the few areas in which the individual organization has more management control than most any other aspect of the operation of the business enterprise, including sales, competitive conditions, market conditions, and raw material costs, to name just a few. In short, external forces do not dictate safety performance.

This literature review is organized according to concepts that emanated from the purpose and research problem, and were derived from business related safety studies published in journal articles, dissertations, and meta analyses, as presented in the concept map below. Keyword searches and the overall methodology for locating relevant research

is referenced in Appendices D and E. Empirical safety studies on climate/culture and safety performance indicators from 1997 to 2008 were selected for the review of literature. The review begins with the higher order concepts (Gloeckner, 2009), namely organizational culture, climate, and organizational performance and proceeds to explain the relationship among safety culture, climate, organizational practices, and the prediction of safety outcome variables.

1. Definitions and distinctions between culture and climate are presented.
2. The research design and summary of findings for safety culture and safety climate studies are provided.
3. Furthermore, this review of literature will provide a background for understanding the design of this study, to include the rationale for the selection of independent and dependent research variables.
4. Studies included in the review were selected according to their emphasis on safety culture and or climate and safety performance.

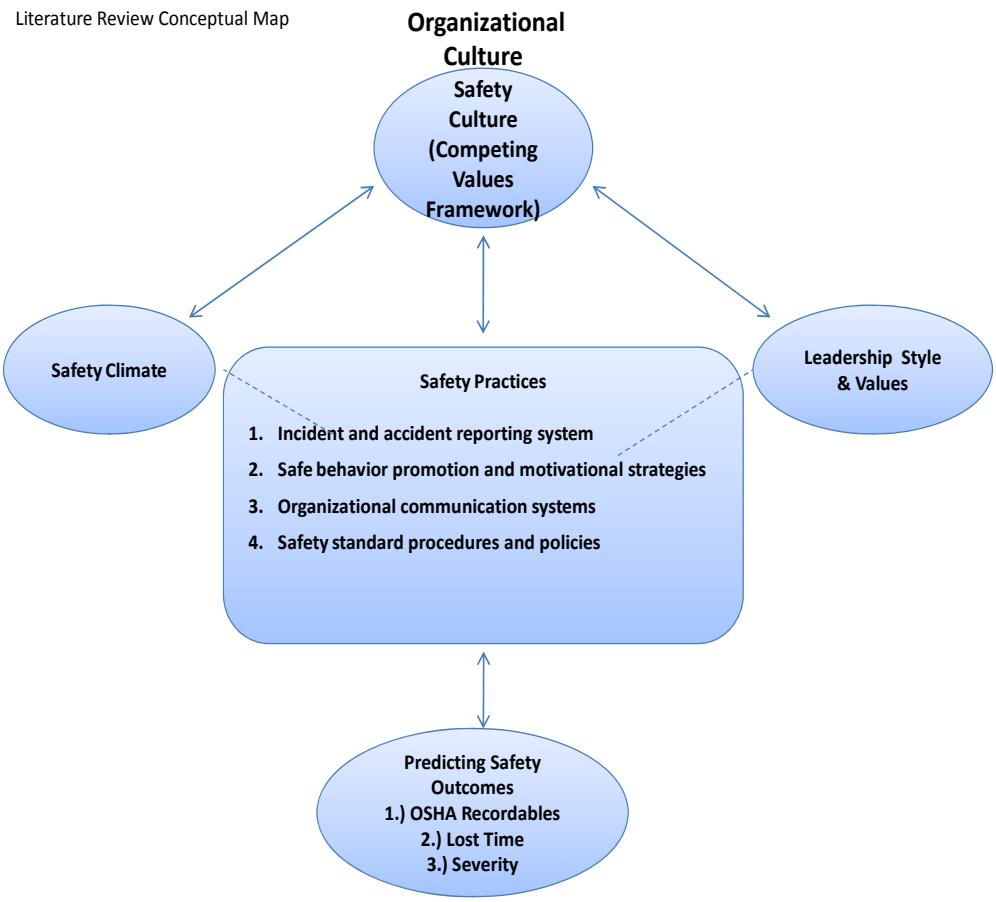

Figure 2. Literature Review Concept Map

Distinction Between Organizational Culture and Climate

Schein defined organizational culture as

> "A pattern of basic assumptions invented, discovered, or developed by a given group as it learns to cope with the problems of external adaptation and internal integration that all works well enough to be considered valid and therefore to be taught to new members as the correct way to perceive, think, and feel in relation to those problems" (1992, p. 9).

Essentially, organizational culture refers to "what employees perceive to be the pattern of beliefs, values, and expectations that guide behavior and practice within an

organization" (Gilley & Maycunich Gilley, 2003, p. 149). Further, Schein (2004) distinguished levels of an organization's culture by "artifacts, espoused beliefs and values, and underlying assumptions" (2004, p. 46). Organizational artifacts include "visible structures and processes" (1992, p. 26) such as organizational charts and policies, which provide insight into the daily functioning of an organization. Artifacts are indicators of organizational beliefs and values, but may not mirror the actual values of individual managers.

Several scholars differentiate climate from culture based on the level of analysis. As such, climate is focused on the work group or micro level of the organization, whereas, culture is reflective of the overall organization (Burke, 2008; Gilley & Maycunich Gilley, 2003; Schneider, 1985). Organizational performance and change models, such as Gilley and Maycunich's (2003) Organizational System Blueprint Model, illustrate the relationship between climate and culture based on the micro and macro levels of the organization. Safety climate is one of the organizational components of culture that is connected directly to the mission, strategy, and organizational practices. Work climate is linked to managerial practices and organizational processes, including communications and decision-making. Ultimately, the organizational processes and individual and organizational performance are tied to the organization's performance results.

Climate is differentiated from culture as referenced in Table 2, in that it refers to employee attitudes and perceptions affecting colleagues' "day-to-day work together on the job" (Burke, 2008, p. 185). According to Schein, culture is defined as "systems of shared meanings, assumptions, and underlying values" (Schein, 1985, as cited in

Schneider, 1990, p. 22). Burke also makes a distinction between climate and culture with regard to time in terms of short-lived perceptions and attitudes versus more long-term organizational attributes.

Table 2

Selected Definitions of Organizational Culture and Climate.

Organizational Culture	Organizational Climate
"Culture is more background and defined by beliefs and values. The level of analysis for culture is the organization" (Burke, 2008, p. 184).	"Climate is defined in terms of perceptions that individuals have of how their local work unit is managed and how effectively they and their day-to-day colleagues work together on the job. The level of analysis, therefore, is the group, the work unit. Climate is much more in the foreground of organizational members' perceptions" (Burke, 2008, p. 185)
"Systems of shared meanings, assumptions, and underlying values" (Schein, 1985, as cited in Schneider, 1990, p. 22)	Organizational climate generally refers to how employees perceive their work environment, which influences their work-related attitudes and behaviors. It provides a frame of reference through which individuals make sense of organizational life (Joyce & Slocum, 1984, as cited in Ngo, Foley, & Loi, 2009, p. 668).
"A set of understandings or meanings shared by a group of people. The meanings are largely tacit among members, are clearly relevant to the particular group, and are distinctive to the group. Meanings are passed on to new group members" (Louis, 1980, as cited in Frost, Moore, Louis, Lundberg, & Martin, 1985)	Burton, Lauridsen, and Obel (2004, p. 69) defined organizational climate as ''an individual's attitude concerning the organization, comprised of its degree of trust, morale, conflict, rewards equity, leader credibility, resistance to change, and scapegoating.''
"Any social group, to the extent that it is a distinctive unit, will have to some degree a culture differing from that of other groups, a somewhat different set of common understandings around which action is organized, and these differences will find expression in a language whose nuances are peculiar to that group" (Becker	Bowen and Ostroff (2004, as cited in Ngo et al., 2009, p. 669) argued that a strong organizational climate affects how employees share a common interpretation of what behaviors are expected and rewarded, and hence a situation is created for better organizational performance.

Organizational Culture	Organizational Climate
& Geer, 1970, as cited in Frost et al., 1985)	

Relationship Between Organizational Culture, Organizational Practices, and Organizational Performance

Research has shown that organizational performance varies according to types of organizational cultures based on the Competing Values Framework classification. There are four dominant culture types as follows: policy-oriented, goal-oriented, supportive, and innovative cultures. For example, Yeung, Brockbank, and Ulrich (1991) conducted a factor analysis of 12 questions on organizational culture related to six HR practices including: staffing, development, performance appraisal, reward, communication, and organization design. Performance was compared to that of competitors according to 15 business activities. Further, the reliability coefficients for each of the practices were at least .80. There were differences in performance outcomes depending on the culture approach to the referenced organizational practices.

The premise of the first hypothesis was that "organizational performance and HR practices vary with different organizational cultures" (Yeung et al., 1991, p. 67). Hypothesis 2a was that "Different Human Resource practices in organizations with different dominant culture types are significantly different" (p.65). The premise of Hypothesis 2a was that "HR practices significantly influence organizational culture" (p.67). The findings revealed that stronger culture scores were correlated with stronger organizational performance relative to competitors according to financial indicators. For example, the companies with a strong comprehensive culture had standard scores of 1.46

and scored .31 for organizational performance, whereas those with weak comprehensive culture scores had a -1.0 for culture strength and a -.28 score for organizational performance. There were significant differences in the standard scores for the HR practices (p<.001) (F, 25, 21, 29, 24, 27, 21) among the culture clusters including: strong, comprehensive culture, group-driven, hierarchy-driven, development-driven, and weak comprehensive culture.

Safety culture defined

The term "safety culture" was first used in 1986 in an International Safety Advisory meeting following an accident. Since then, the term has multiple meanings; there is not a universal definition of "safety culture" (Rao, 2007). According to Guldenmund (2000, 2007), safety culture has been well studied; however, researchers have not reached a consensus on the dimensions that constitute a safety culture. Research studies have shown anywhere from "2 to 19 safety culture dimensions ranging from management to risk awareness" (Borjesson, 2008, p. 2) and attitudes and perceptions of the safety climate. The commonly cited dimensions of a positive safety culture presented in a dissertation on predictors of work-related injuries (Flin, Mearns, O'Connor, & Bryden, 2000; McConnell, 2004) include: "commitment by management and workforce, leadership style and communication, individual responsibility, management responsibility, risk awareness and risk-taking" (McConnell, 2004, p. 14).

Some of the common components addressed in the definitions of "safety culture" include the following: "safety management" (Choudry, Dongping, & Mohamed, 2007, p. 207) "safety system" (Choudhry et al., 2007, p. 208) "safety climate" (Choudhry et al., 2007, p. 207; Hale, 2000, p.2) "safety management system" (Hale, 2000, p. 2; Diaz-

Cabrera, 2007, p. 1202) "socio-technical system" (Grote & Künzler, 2000, p. 452; Leveson, Dulac, Marais, & Carroll, 2009)and "behavior-based safety" (Choudhry et al., 2007, p. 208).

Safety culture indicators are classified according to formal versus informal norms. The formal norms in a safety culture are characterized as written organizational safety policies and procedures, such as OSHA regulations, whereas the informal norms are not documented (Rao, 2007, p. 730). Rao contends that social networks and trust among employees is a critical aspect of informal norms that frequently determine whether employees will make safety first. Trust forms group cohesiveness and impacts employees' actions regarding one's personal safety and others' safety regarding safe work practices, protective equipment, and appropriate safety interventions.

Therefore, one can posit that even if the organization has a number of formal aspects of a "safety culture," yet lacks the critical informal norms, then safety is likely not part of the culture. Furthermore, a safety culture cannot be assessed exclusively through observable behaviors and organizational artifacts, but must also include perceptions of daily practices, attitudes, and beliefs. Table 1 presents selected definitions of safety culture and the corresponding dimensions cited in the research from 2000 to 2008.

Table 3

Selected Definitions of Safety Culture and Characteristics.

Definition	Reference	Characteristics of Safety Culture
"Safety culture should not be something separate from – or in addition to – an organizational culture, but constitute an integrated part of this."	(Haukelid, 2008, p. 416)	Integrated part of organizational culture
"Safety culture can be viewed as a component of corporate culture, which alludes to individual, job, and organizational characteristics that affect and influence health and safety."	(Cooper, 2000, p. 627; Fernandez-Muniz, Montes-Peon, & Vazquez-Ordas, 2007)	• Individual features • Job features • Organizational characteristics • Affect and influence health and safety
"Considering some of the ways in which safety social capital can work for an organization as discussed above, it follows logically that safety social capital is indeed very indispensable to organizations in order to have a positive safety culture."	(Rao, 2007, p. 732)	Social capital
"Safety culture can be construed to be manifested in shared values and meanings, and in a particular organizational structure and processes, safety policies, strategies, goals, practices, and leadership styles related to safety management system." "Safety culture is a recent, polemic and complex concept that requires considerable theoretical and empirical clarification" (Diaz-Cabrera et al., p. 1203).	(Díaz-Cabrera et al., 2007, p. 1203)	• Shared values and meanings • Particular organizational structure • Processes • Policies • Strategies • Goals • Practices • Leadership style
"Safety culture can be described as a set of beliefs, norms, attitudes and social technical practices that are concerned with minimizing the	(Ahmad & Gibb, 2003, p. 30)	• Beliefs • Norms • Attitudes • Social technical practices

Definition	Reference	Characteristics of Safety Culture
exposure of individuals, within and beyond an organization, to conditions considered dangerous or injurious."		
Definition of a *positive* safety culture: "A set of values, perceptions, attitudes and patterns of behavior with regard to safety shared by members of the organization; as well as a set of policies, practices and procedures relating to the reduction of employee's exposure to occupational risks, implemented at every level of the organization, and reflecting a high level of concern and commitment to the prevention of accidents and illnesses."	(Fernandez-Muniz et al., 2007, p. 628)	• Values • Perceptions • Attitudes • Patterns of behavior • Policies • Practices • Reduction in occupational risks • Commitment to prevention of accidents and illnesses

Table 3

Safety Climate Characteristics

Authors	Safety Climate Characteristics
Glendon & Staton (2000)	Communication and support - Suitability of procedures - Work pressure - Personal protection team - Safety norms - Relations
Cooper & Philips (2004)	Attitudes, risk level, Importance of training Effects of safe behaviour on promotion Status of safety personnel
Seo et al. (2004)	Commitment of management - Support from supervisor - Support from coworkers - Employee participation - Level of competence
Lu & Shang (2005)	Safety of supervisor - Safety of job - Safety of coworkers - Safety management - Safety training

	- Safety norms - Job pressure
Nielsen et al. (in press)	Safety leadership - Leadership of immediate supervisor - Safety instructions - Commitment to safety - Safety violations
Evans, Glendon, & Creed (2007)	Management commitment and communication - Safety training - Team and maintenance

Note: Adapted from "Safety Climate Dimensions (Diaz-Cabrera et al., 2008).

Distinction Between Safety Culture Versus Safety Climate

As shown in Table 1, Díaz-Cabrera, et al.(2007) assert that if a culture of safety exists then it is interwoven with the organizational culture, which is congruent with Mathis' (2009) claim that "traditional safety" should not be separate from a "culture of safety" (p.22). Safety climate is clearly a sub-component of safety culture related to individual and group attitudes and behaviors related to engagement in safety practices (Cooper, 2000; Fernandez-Muniz et al., 2007).

A positive safety culture is the product of individual and group values, attitudes, perceptions and an extension of climate to also include the overall "commitment to safety, values, and trust" (Diaz-Cabrera et al., 2008, p. 85). According to Findley, et al. (2007), "safety climate describes the safety attitudes and perceptions of employees at a single point in time in an effort to identify system weaknesses and opportunities for safety improvements"(p. 876). Definitions of both culture and climate emphasize shared beliefs and values regarding safety. Tables 2 and 3 also reflect the overlap between the dimensions of safety climate and culture.

Relationship Between Safety Culture, Organizational Practices, and Safety Performance Indicators

The research literature discusses several competing approaches to developing a positive safety culture through organizational practices and values (Hale, 2000; Richter & Koch, 2004). Given the difficulty of defining safety culture, the issue of how to examine safety culture remains and for this reason, a majority of the studies focus primarily on safety climate. Despite multiple attempts to explain safety culture through competing models, there is limited empirical research to substantiate which dimensions of organizational practices and values have the most influence on actual safety performance. For example, researchers such as Rundmo (2000) have studied approaches to developing a safety culture through safety climate measures encompassing safety attitudes, risk perception, and behaviors; yet, their model's linkage to actual safety performance indicators is unclear (Hale, 2000). More research is needed to study other aspects of culture, in addition to safety climate, to determine if there is a relationship between safety culture and organizational performance.

Beginning with Zohar's (1980) studies on safety climate, this review evaluated the link between safety climate and safety performance. Research cites evidence to support the influence of safety climate on safety performance indicators (Clarke, 2006; Rundmo, 2000; Varonen & Mattila, 2000; Zhou, Fang, & Wang, 2008; Zohar, 1980). Zohar (1980), known for his extensive research on climate, predicted safety performance at the group level within an organization from "safety climate scores" (Findley et al., 2007, p. 878). Zohar also showed that a comparison of "safety level and accident/incident

data and safety climate scales discriminated between organizations with different levels of safety" (Isla Díaz & Díaz Cabrera, 1997, p. 647).

The referenced studies suggest a relationship between safety climate and safety performance, yet, questions still remain regarding the best measures of safety climate. Policies and procedures is the second most frequently occurring scale within safety climate survey research (Clarke & Flitcroft, 2006). Isla Díaz and Díaz Cabrera (1997) interpreted the results of their safety climate and attitude study of three companies at a European airport suggesting that "one of the most critical areas related to safety climate seems to have been the company organizational policies" (p.648). The results also supported Schneider's (1990) findings that "safety policies acting through the safety climate have an impact on the safe behavior of the workers" (Isla Díaz & Díaz Cabrera, 1997, p. 648). Safety climate accounted for 55% of the variance for the perceived safety climate measured according to a) safety policies and procedures, b) communication, and c) organizational support (DeJoy et al., 2004).

Safety studies have measured policies and procedures that are in place in organizations with positive safety cultures. However, "it is practically impossible to develop safety rules and procedures that respond to all given situations in organizations" (Diaz-Cabreara et al., 2007, p. 1202). Therefore, it is important to understand which values undergird the safety practices of organizations known for having a positing safety culture because the values ultimately impact behavior, despite policies and procedures that are in place.

Varonen and Markku (2002) assessed 22 safety variables associated with organizational practices and the work environment in eight wood-processing companies

in 1990 and 1993. Three factors of safety climate studied in relation to accident rates were a) safety activities of management and safety personnel, b) anticipation of hazards, and c) safety training. Their study confirmed the hypothesized relationship that higher scores on safety climate and accidents correlated with lower accident rates. Some of the company practices consisted of "organizational responsibility, workers' safety attitudes, safety supervision, and company safety precautions" (p. 767). The results of the Varonen et al. study were also consistent with Neal and Griffin's (2006, as cited in Hedlund et al., 2010) research, which established the "connection between safety climate and employee safe working practices" (p.2).

Silva, Lima, and Baptista (2004) established measures of safety climate according to the four culture orientations of the Competing Values Framework. The instrument was administered in 15 industries to 930 employees. Confirmatory factor analysis revealed that the questions were "compatible with the four safety orientations" and that "structures could be applied to companies in several industries" (p.218). In addition, they examined differences among the newly established safety climate dimensions and low and high accident and severity rates in 1999. Strong correlations existed between the following safety-related practices and accident frequency and severity rates: a) safety as an organizational value, b) management safety activities, c) communication related to safety d) learning from accidents, and e) employee involvement in promoting safety.

Table 4

Summary of Select Empirical Studies since 1997 on Safety Climate and Culture Variables and Safety Performance Indicators.

Author, Date	**Method**	**Independent variables**	**Classification of Predictor Variables**	**Sample**	**Purpose**	**Findings**	**Safety Outcome Variables**
(Isla Díaz & Díaz Cabrera, 1997)	One way ANOVA Regression	Attitude Age Climate Education levels Time working in the company Hierarchical position Whether working on a ramp	Situational & Personal Factors	Airplane fuel company, N=247 airport authority N=45 Ground handling company N=73	"The main aim of this research is to develop a set of evaluation measures for safety attitudes and safety climate" (p.643).	There were "significant differences in attitude with respect to the type of company and whether employees work on a ramp (p. 646).	Safety level Accident/ incident data
(Vredenburgh, 2002)	Multiple Regression	Worker participation, safety training, hiring practices, reward system, management commitment, and communication & feedback	Management Practices	62 hospitals	"Examine degree to which six management practices contributed to safe work environment"(p.259)	"Overall, the management practices predicted injury rates"(p.259)	Number of injuries within 15 categories i.e. sprains, strains, and fractures
(Holland, 2003)	One-Way ANOVA Cross-tabulation	Team members' time with the company, teams' time with the company, team members' experience on safety issues, teams' time together, co-chairs' time with the safety team	Historical background factors on safety teams	Five UPS teams with the highest and lowest Days Away Restricted Transfer (DART) rates	"Improve the effectiveness of safety teams at the UPS, Air District Hub, Louisville, Kentucky." (p.11)	"Data revealed varying responses from UPS employees designated as group A and B. Also, the demographic information is valuable for indentifying and understanding a successful safety team" (p. 184).	Days Away Restricted Transfer (DART) rates

Summary of Select Empirical Studies since 1997 on Safety Climate and Culture Variables and Safety Performance Indicators.

Author, Date	**Method**	**Independent variables**	**Classification of Predictor Variables**	**Sample**	**Purpose**	**Findings**	**Safety Outcome** *Variables*
(DeJoy, Schaffer, Wilson, Vandenberg, & Butts, 2004)	Hierarchical Regression Analysis, Partial Correlations	Organizational climate, organizational support, participation, & communication	Environmental conditions, general organizational climate, safety policies and procedures	21 retail organizations in southeastern U.S.	Assess the role of safety climate in determining safety performance indicators	Policies and procedures accounted for 45% of the variance of the perceived safety climate.	Perceived safety at work
(Fernandez-Muniz et al., 2007)	Structural Equation Modeling	Safety policy, incentives, training, communication, planning, control, and managers' commitment	Safety management system	455 Spanish firms in the construction, industrial, and service sectors	Propose a model of a positive safety culture	The goodness-of-fit indices of the suggested model shown may be considered satisfactory since they are very close to the recommended values" (p.632).	"Respondents were asked to provide information relating to their safety performance in terms of their degree of satisfaction with: (a) the number of personal injuries; (b) the material damage; (c) the employees' motivation; and (d) the absenteeism

Summary of Select Empirical Studies since 1997 on Safety Climate and Culture Variables and Safety Performance Indicators.

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(Wu, Chen, & Li, 2008)	Multiple Regression Path Analysis Canonical Correlation Analysis	CEO's safety commitment, managers' safety commitment, employees' safety commitment, emergency responses, perceived risk, safety caring, coaching, and controlling	Safety leadership, safety climate	Faculty and staff of laboratories in 4 Taiwanese colleges/universities	"Aim was to investigate the correlation among safety leadership, safety climate and safety performance in university and college laboratories" (p.309).	"Two paths were found that affect performance. One goes from safety leadership, through safety climate, to safety performance, where the other goes from safety leadership to	Safety organization and management, safety equipment and measures, accident statistics, safety training evaluation, accident investigations and safety

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						safety performance: (p. 314).	training practices

Relationship Between Values and Leadership Styles Related to Safety

Bruno and Lay (2008) outlined several theories suggesting that managers' values shape their leadership styles (Covey, 1990; Tannenbaun & Schmidt, 1958). In fact, Fielder developed a leadership theory "based upon the argument that managers cannot be expected to adopt a particular leadership style if it is contrary to their value orientations" (1967, as cited in Bruno & Lay, 2008, p. 679). Most recently, Bruno and Lay (2008) conducted a non-experimental study to determine whether there was a relationship between executives' personal values and leadership effectiveness and organizational effectiveness. Their study assessed executives' leadership styles as the basis for measuring leadership effectiveness according to Hersey-Blanchard's Leader Effectiveness Model (1969). Leadership styles of the executives represented two dimensions related to task behavior and relationship behavior and were segregated into "telling, selling, participating, and delegating" (Bruno & Lay, 2008, p. 681).

The Leader Effectiveness and Adaptability Description (LEAD) instrument measured leadership effectiveness according to leadership adaptability. According to the Hersey-Blanchard's Leader Effectiveness Model (Hersey et al., 1969), the more adaptable the leadership style is, the more effective the leader. The organizational effectiveness indicators were: net profit, inventory turns, fixed assets turns, depreciation/material costs, expenses/net sales, and fixed assets/net sales. The sample size consisted of 400 business executives from 48 organizations in the Manaus Industrial Cluster; there was a strong correlation (.89) between the executives' organizational effectiveness based on leadership style adaptability, and the espoused values from the

scores on the values balance orientation. The study suggested that the lack of leadership style adaptability was due to low scores in political orientation because the executives place little value on influencing people.

Zohar and Luria's (2005) Multilevel Model of Safety Climate examined the relationships between group and organizational level factors that have been shown to influence climate. "Management modes of control" were classified as "compliance, commitment, and participation" and further categorized as proactive, active, and declarative, which correspond with climate types at the organizational level. The model's questionnaire emphasized supervisory practices and was designed to measure indicators of competing management goals such as safety and productivity. Similarly, Wu et al.'s (2008) safety leadership measures include "safety caring, coaching, and controlling" (p. 309).

Managers may claim to espouse certain values through their speech, "strategies, goals, and philosophies" (Schein, 2004), but those values may not align with their actions, which Gilley and Maycunich Gilley refer to as "managerial malpractice" (2003, p. 160). For example, a manager could claim that safety is his or her priority; however, that particular manager may not enforce the safety policies because he/she believes that his or her plant will close if productivity does not increase. Moreover, the manager could reward employees for increasing production volume on a routine basis, thus, diminishing the emphasis on safety. The manager referenced above has a "producer" leadership style (Cameron & Quinn, 2006, p. 46) characterized by a focus on motivating employees and getting the job done, and in this case, without considering safe working practices.

Underlying assumptions reflect managers' "theory-in-use" (Schein, 2004, p. 31). Costco's CEO, Jim Singegal, is a prime example of providing consistent leadership because his underlying assumptions are congruent with his espoused values. His assumption about employees is that, "if you pay people well, you get good people and good productivity" (Maxwell, 2007, p. 48). Indeed, Singegal pays his employees exceptionally well, and as a result, he has been criticized for paying his employees too well. Employees are "paid 42 % more than the company's chief rival" (p. 48). In fact, Costco has some of "the lowest turnover rates in all of retailing" (p.48). Maxwell describes Senegal as a caring, servant leader who treats his employees well. Each year, he visits all Costco stores where he is known on a "first-name basis with everyone" (2007, p.48).

Applying Competing Values Framework to Leadership and Organizational Practices

Cameron and Quinn's Competing Values Framework, the conceptual framework for this study, has been tested over the last 26 years. Cameron and Quinn's (1999, 2006) Competing Values Framework contrasts the underlying value drivers, leadership types, and strategic orientation for the four types of organizational cultures. The Organizational Culture Assessment Instrument (OCAI) is designed to measure underlying assumptions of management and the organization and thus, describe the leadership style associated with each culture type. For instance, leadership styles characterized as a "mentor, team builder, or facilitator" exemplify values related to "human development" (Cameron & Quinn, 2006, p. 46).

Cameron and Quinn have also devised a Competing Values Framework of Leadership Behavior representing leadership styles according to the four culture models (Frost et al., 1985). For example, leaders that value "certainty and long time lines" will likely "employ a hierarchical information processing style" and will fit best in a policy oriented culture. Conversely, leaders that value "short time lines and low certainty" take on "innovator and broker roles" characterized by "risk-taking, aggressive leadership styles" (p. 323-324).

Questionnaire of Safety Culture Values and Practices

Díaz-Cabrera et al., adapted a model of safety culture from the Competing Values Framework (Cameron & Quinn, 1999; Quinn & Spreitzer 1991; Quinn & Kimberly, 1984) to study the following five safety practices and values related to performance in multiple safety culture studies: a) company values, b) leadership style, c) motivation patterns, d) training programs, e) communication, and f) usage of accident information (Cox & Cox, 1991; Coyle, Sleeman, & Adams, 1995; Diaz-Cabrera et al., 2008; Glendon & Litherland, 2001; Guldenmund, 2007; Isla Díaz & Díaz Cabrera, 1997; O'Toole, 2002; Zohar, 1980).

Isla Diaz and Diaz Cabrera (1997) developed a safety climate instrument as a precursor to the development of the Questionnaire of *Organizational Safety Culture Values and Practices* (2007). The purpose of the study was to assess the relationship between safety climate and accident rates in airport ground handling companies. The published study was administered to managers and operators at an airport fuel company, airport authority, and ground handling Services Company in Spain. Operators and mid-level managers were included in the sample of 299 employees. Exploratory factor

analysis was conducted and revealed six factors of safety climate explaining 60.8% of the total variance. Company policy towards safety was the single most important dimension of safety climate, which accounted for 38% of the variance in safety climate. Organizational emphasis on productivity versus safety explained 6.4% of the variance in safety climate.

The instrument measured the following dimensions of attitudes and climate: (a) strategy/company policy towards safety matters (b) emphasis on productivity versus safety (c) group attitudes towards safety (d) specific strategies for [accident] prevention (e) safety level perceived in the airport (f) safety level perceived on the job. A One-Way ANOVA was conducted to examine differences among each of the climate factors and the companies with varying levels of safety performance. Together, safety climate factors and the three types companies were significant (F=4.22, p=.001). Significant differences were found among the level of safety performance for the companies according to F(2,56) and p. <.01. Effect sizes were not presented.

A decade later, Diaz-Cabrera, et al's (2007) questionnaire was extended beyond the six attitudes and perceptions of the climate factors to measure safety culture through the following six organizational factors: a) company values, b) leadership style, c) motivation patterns, d) training programs, e) communication, and f) usage of accident information. The questions were designed to measure constructs that extend beyond the perception of the incident and accident reporting system to identify the objectives for the reporting system, methods for soliciting feedback, and how the feedback is used.

1. In my company, employees only contribute information about incidents and accidents that are clearly observable and/or serious.

2. In my company, employees participate in the development of new incident and accident reporting systems and new work procedures.
3. In my company, employees participate in the development of new incident and accident reporting systems and new work procedures.

The above questions were adapted from the Competing Values Framework (Cameron & Quinn, 2006) to demonstrate how organizational practices, such as the incident and accident reporting system, would be approached according to the organizational culture. For instance, in a policy-oriented safety culture, the objective of the reporting system is primarily to ensure compliance with safety policies and procedures. Conversely, the objective of the reporting system in a supportive environment is to "increase commitment to safety" based on the type safety culture, types of motivation, and the underlying values (Diaz-Cabrera, 2007, p. 14).

Research Design for Dissertation Study

In regards to the presented studies and findings, this dissertation study will explore five independent variables consisting of organizational practices and values, and three dependent variables including: OSHA recordable rates, Lost Time Away (LTA), and severity rates serve as measures of safety performance indicators. This author noticed two trends among the review of the literature both from the level of analysis and the purpose for conducting the studies. First, most studies were conducted at the individual and group levels. A common theme among the variables in safety culture research included employee perceptions towards safety policies and procedures rather than an assessment of the organization's overall values and commitment to safety (Guldenmund, 2000). However, an exception was the Isla Díaz and Díaz Cabrera (1997) study that

compared employee attitudes regarding safety by company and by management, mid-level management, and operator positions to study variations in safety climate and attitudes across organizational levels (p. 646). These levels of analyses permitted the study of both person and situational factors by considering individual demographic data and job classifications exposed to varying degrees of safety risks. Employees "that worked on a ramp were shown to have a less positive attitude than employees who did not work on a ramp" (p.646). Similarly, this study will assess variations in safety culture approaches to five organizational practices by plant and by job classification.

Second, the purpose of most of the reviewed safety studies was to determine which safety practices, such as training and safety communications correlate with a positive safety climate. However, few studies compared the dimensions of each practice, or approach to each safety practice, as a predictor of a positive safety culture. For example, Fernandez-Muniz, et al (2007) studied nine safety practices, such as communication to formulate a model of positive safety culture. Communication was measured in terms of whether "there was a transfer of information to employees about the possible risks in the workplace" (p. 631) and was shown to have a .95 regression coefficient with the safety management system. Yet, the study did not classify approaches to employee communications according to whether the discussions were personalized or global, or whether they were proactive or reactive responses. Therefore, it is not known whether a measure of the varying employee communications approaches would have changed the communication regression coefficient with the safety management system, and in turn, affected the influence on the positive safety culture model.

Richter and Koch's (2004) ethnographic study recognizes three distinct safety cultures including: production, welfare, and master based on Ullmark's (1986) metaphors, *Welfare and Master.* Further, their review of "case studies in Danish manufacturing showed that it usually is necessary to differentiate between several safety cultures dispersed throughout the shop floor and other parts of the manufacturing organization" (p.703). Similarly, this dissertation will compare the responses regarding the safety culture of both managers and operators among four position types by plant. In addition, this study will examine whether safety culture types are predictive of safety performance indicators. Richter and Koch's (2004) study did not "link accident rates to the safety cultures discussed" (p.711).

The reviewed empirical studies were designed from the perspective of a singular view of cultures. As Richter and Koch stated, "Many safety culture scholars maintain a unitary, integrative and monolithic approach to culture" (p.704). Yet, scholars in organizational culture have studied distinguishing traits and typologies of organizational culture such as Hofstede, McGregor, Denison, and Cameron and Quinn (Quinn & Spreitzer, 1991).

Safety Culture Values and Practices Variables

Safety performance indicators or the dependent (criterion) variables for this study included: OSHA recordable rates, Lost Time Away, and severity rates for the regression analysis and were also the independent variables for the Independent t-tests. The independent (attribute or predictor) variables for regression and the dependent variables for the Independent t-tests were: the company values, leadership style of immediate supervisor, usage of incident and accident information, communication, and motivation.

The four safety culture types were: supportive, innovative, goal-oriented, and policy-oriented.

Safety Outcome Variables

This section will evaluate several measures of safety performance indicators to establish how the safety outcome variables for this dissertation study were selected. Management, engineering, and occupational health and safety research present conflicting views on which quantifiable safety performance measures should be used to gauge whether an organization has a safety culture (Fernandez-Muniz et al., 2007). "Some authors argue that the reduction in accident and incident rates provides the best measure of the safety culture" (Fernandez-Muniz et al., 2007, p. 631). However, employees do not always report near misses and incidents due to the accident free incentive based systems and therefore, incident rates are not always accurate measures of safety performance.

The Occupational Safety and Health Act of 1970 mandates that private sector employees record "work-related injuries and illnesses" (Eisenberg & McDonald, 1988, p. 58). The calculations are based on the assumption that employees are honest and report all incidents. Both OSHA and the Bureau of Labor Statistics recognize that there are injuries and illnesses are not reported. Incident rates are not always reported accurately due to limited knowledge regarding proper procedures, as an example (Eisenberg & McDonald, 1988). Additionally, work-related illnesses can be difficult to trace to specific working conditions over a period of time and therefore are not reported.

OSHA classifies safety performance indicators as leading or lagging indicators of safety performance in that leading indicators are a proactive measure of safety behaviors,

which reflect employee participation in worksite, task, and hazard analyses. Lagging indicators are reactive measures indicating number of incidents, but are federally mandated indicators of safety performance. OSHA recordables are based on standard calculations for comparisons across industries as noted in Appendices A, B, and C. However, these are not intended to be the sole measures for evaluating safety performance. For these reasons, this dissertation study will utilize three different measures of lagging indicators: OSHA, LTA, and severity rates.

Choudry, Dongping, and Mohamed (2007) developed a model of safety culture for the construction industry. The outcome variables were generalized as "increase in safe behaviors and reduction in incident rates" (p. 210) Such a model is fit for an organization with a behavioral based safety management system to ensure clear definitions of safe and unsafe behavior based on policies and procedures, risk assessments, "checklists and group discussions" (p. 209).

It has not been determined whether the referenced independent variables can be predictors of OSHA safety performance. Thus, the sampling procedures will be conducted similarly to Holland's (1990) dissertation in which he selected the five UPS teams with the highest and lowest Days Away Restricted Transfer (DART) rates.

Few studies investigated which variables contributed to a specific type of safety culture as Díaz-Cabrera, et al. (2007) applied the policy-oriented, goal-oriented, supportive, and innovative organizational culture types (Cameron & Quinn, 1999, 2006) to safety culture. Therefore, the independent variables in this dissertation study will extend beyond policies and procedures to also include five organizational practices and values. The review of literature highlighted the significant components of a safety culture

including: leadership style of the immediate supervisor, incident and accident reporting systems, communications systems, safe behavior motivation and promotion. Thus, this study will apply an instrument based on an organizational culture typology to investigate the missing link safety culture types in relation to OSHA, LTA, and severity rates as indicators of levels of safety.

CHAPTER THREE - METHODS

This section will discuss the proposed methodology to address the research questions in regards to the problem as follows: a.) Description of sites and participants, b.) Rationale for data collection procedures based on methodology choice, c.) Discussion of instrumentation, including scale of measurement, and d.) Presentation of research questions and corresponding analysis.

The purpose of this study was to prevent workplace injuries and to save lives through improved organizational safety practices. Diaz Cabrera et al., (2007) identified the following five values and organizational practices as key measures of safety culture: a) company values regarding incident and accident reporting and safety promotion, b) leadership style, c) communication, d) motivation, and e) usage of accident information. This study was designed to evaluate these five factors according to their ability to predict safety performance.

Despite multiple attempts to explain safety culture through competing models, there is limited empirical research to substantiate which dimensions of organizational practices and values have the most influence on actual safety performance. Therefore, it is important to administer a diagnostic instrument, based on four culture models, to determine if the proposed safety culture types for certain organizational practices and values are predictive of 2009 safety performance.

Research Design and Rationale

Quinn and Spreitzer (1991) reference the debate over qualitative versus quantitative methodologies for studying organizational culture. Studies utilizing qualitative research have been used to understand and describe cultures. Yet, one of the limitations of using qualitative research methods has been the inability to compare culture dimensions across organizations. Given that the purpose of this study is to promote changes in safety practices based on the safety

performance indicators for several plants within the company, a comparison of the dimensions of the organizational practices and the corresponding outcomes is needed.

Theoretical Frame and Grounding of Proposed Methodology

This study was designed from the postpositivist paradigm. The researcher adheres to the belief that phenomena regarding safety perceptions, attitudes, behavior, and safety performance indicators can be best explained as "causal relationships" (Egon G. Guba, 1990; Phillips & Burbules, 2000). Values influence attitudes and behaviors, which in turn affect safety performance. Hence, the knowledge about company values and safety culture in this study was gained through an investigation of differences in safety practice scores representative of types of safety culture and the corresponding 2009 safety performance indicators. The difference questions determined whether specific safety practices and the classification of safety culture types discriminated plants according to their OSHA recordable rates, LTA, and severity rates.

According to Guba, Lincoln, and Denzin, (2000), the ontological assumptions of postpositivism is that there is a "real reality," but it is only imperfectly and probabilistically apprehendible" (p. 193). Further, this study was designed to make "probabilistic statements of association" (Carlile & Christensen, 2005, p. 3) of 2009 OSHA recordable rates, LTA, and severity rates for the company based on the sample of the plants that achieved and failed to achieve the 2009 target rates for the three key indicators of safety performance. The epistemological assumptions of the postpositivist paradigm outlined in the data collection section include: "critical intersubjective verifiability across heterogeneous perspectives" (Cook, 1983, pp. 83-84) across plants regarding organizational safety culture. Inclusion of both management

and employees across plants with the highest and lowest safety performance increase the likelihood that the findings reflect reality than if only one subgroup was sampled.

Conceptual Framework

Due to a lack of empirical research distinguishing between types of safety cultures and the corresponding outcomes, the researcher selected a conceptual framework consisting of an integration of several culture models. Research shows that certain organizational practices shape the organizational culture (Cox & Cox, 1991; Coyle et al., 1995; Glendon & Litherland, 2001; Isla Díaz & Díaz Cabrera, 1997; O'Toole, 2002; Zohar, 1980). Further, Diaz-Cabrera has identified five organizational practices shown to be significant in the safety culture research (2007). The study is grounded in Cameron and Quinn's (2006) Competing Values Framework consisting of four culture models, derived from empirical studies on organizational effectiveness. The Competing Values Framework "can be useful in organizational analysis, in the analysis of organizational change, and in the guidance of practitioners in the execution of organizational development interventions" (p. 116).

Models with emphasis on culture congruency such as Nadler and Tushman's Diagnosis of Organizational Behavior (1980) and Burke-Litwin's Model of Organizational Performance and Change (2008) provide support for the study's theoretical underpinning. The conceptual framework provides the structure of the study and explains the development of the *Safety Culture Values and Practices* diagnostic instrument to assess the current state (Robinson & Robinson, 1995) of the organization's safety culture.

The Competing Values Framework, (Cameron & Quinn, 1999, 2006) reflective of contradictory models of organizational effectiveness, contrasts the underlying value, leadership

styles, and culture orientations for four types of organizational cultures, which have been adapted to examine safety culture. The organizational effectiveness models constituting four safety culture types are presented as follows: supportive (Human Relations Model), innovative (Open Systems model), policy-oriented (Internal Process Model), and goal-oriented cultures (Rational Goals Model). Each model hinges upon management and organization development theory such as McGregor's Theory X and Y, Maslow's Hierarchy, and Open Systems Theory (Mirvis, 1988, 1990, as cited in Denison & Spreitzer, 1991). Culture types are presented along a continuum according to whether the organization has an internal or external focus and whether the organization is typified by stability or control (Cameron & Quinn, 1999, 2006).

A supportive safety culture is typified by employee involvement, team building, and collaboration in promoting organizational commitment to safety. Examples of employee development might include the identification of training needs based on the results of the incident and accident reporting systems and/or individual feedback. An innovative safety culture is flexible and is characterized by changes made in job design, rewards systems, and work procedures to improve safety based on employee feedback and incident and accident reporting. A goal-oriented safety culture has clearly defined safety goals and expectations and corresponding rewards. On the other hand, a policy-oriented culture focuses on the evaluation of safety performance and the consequences of failure to comply with established practices and procedures. The researcher applied the framework to examine the variations in safety performance indicators to prevent work-related injuries and lost time. The researcher used regression to determine if the characteristics of the safety culture of each plant, indicated by the results of this instrument, could predict variations in safety performance.

A strength of this conceptual framework is that it could use be used to pinpoint areas of needed change after analyzing the results of the safety profile (Diaz-Cabrera, et al., 2007). Safety culture type profiles generated from the assessments in this study (Díaz-Cabrera et al., 2007) Cameron and Quinn's (2006) Competing Values Framework can be applied to understand the components of a safety culture and identify culture gaps by plant.

The organizational practices presented in the second box of Figure 1 include: company values (related to incident reporting and safety promotion), motivation, communication, leadership style of immediate supervisor, and usage of incident and accident information (Díaz-Cabrera et al., 2007). The Competing Values Framework classifies the values, practices, and leadership styles according to culture type. Culture types are presented along a continuum according to whether the organization has an internal or external focus and whether the organization is typified by stability and control or by flexibility and discretion (Cameron & Quinn, 1999, 2006). Díaz-Cabrera classifies the values, practices, and leadership styles according to culture type as shown in the third box of Figure 3.

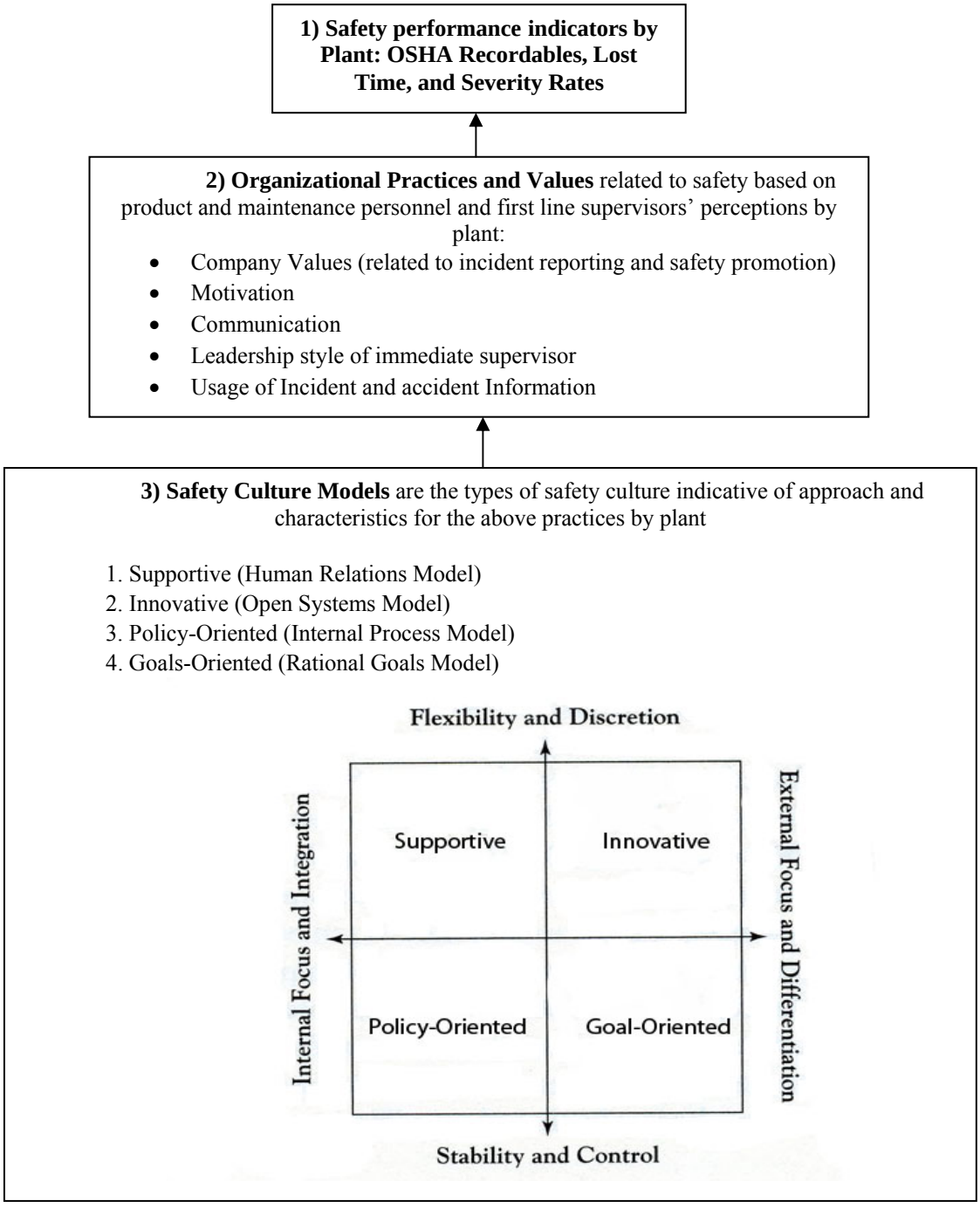

Figure 3. Safety culture models (Diaz-Cabrera et al., 2007). Adapted from *Diagnosing and changing organizational culture: Based on the competing values framework* by Cameron, K. S., & Quinn, R. E. Copyright 1999 and 2006 by Addison Wesley Josey-Bass.

Site and Participants

Physical Setting

The researcher included in the study a total of eight plants, four of which achieved and four of which failed to achieve their 2009 safety goals based on three key safety performance indicators: OSHA, LTA, and severity rates. If the safety culture type was a true predictor of performance, then it should have influenced safety performance of both groups.

Participants

The survey participants included those job classifications with the greatest safety exposure in the performance of their job responsibilities, as well as production and supervisory personnel who contribute to the daily formation of the safety culture within the organization. Those job classifications included the front line supervisors and hourly employees within four confidential job classifications. Each of the survey participants contributes to the formation of a safety culture in manner that was identified through the results of the questionnaire.

The target or theoretical population (Gliner, Morgan, & Leech, 2009) included all operations management and personnel within the entire organization at multi-state plants. The accessible population for this study consisted of all operations management and personnel at 19 plants. The selected sample consisted of production and maintenance personnel and first line supervisors at eight plants. The standard error computed based on the company size and sampling procedures was 2.78%.

Data Collection

According to Guba (1990, p. 192), the goodness criteria, based on the post-positivist paradigm, describe how this study was conducted to maximize objectivity and determine truth

about reality. Data collection strategies that ensured objectivity in this study consisted of: a) measurable, objective indicators of safety performance, b) perspectives from several job classifications from eight plants, c) anonymity of employee responses, d) confidentiality of data, and d) inclusion of both front line supervisors and hourly employees in this study.

The researcher in this study adheres to the beliefs that there is a reality and a perception of reality. The researcher recognizes that data collected in this study are not based on direct observations of behavior and thus, the self-reported data serves as "circumstantial evidence" (Phillips & Burbules, 2000, p. 31) that certain types of safety cultures exist. Furthermore, the data do not necessarily reflect actual reality.

The researcher reviewed Fowler's (2002) recommendations on data collection methods, with priority given to the methods conducive to sampling eight plants. Management permitted data collection during business hours. However, due to the size of multiple plants, costs and time prohibited any interviewer-administered methods. On the other hand, self-administered methods permitted respondents to participate in a "convenient" (p.61) and cost effective manner for the organization, and likely maximize response rates.

Procedure

This study consisted of a two level Hierarchical Linear Modeling design to ensure that the individual responses to the *Questionnaire of Safety Culture Values and Practices* (level 1) could explain any variability in the plant safety performance indicators (level 2). Hence, the results of the questionnaire were aggregated at the plant level, the level of analysis for this research study.

Step I.

Each plant designated a proctor to administer the *Questionnaire of Safety Culture Values and Practices* during the month of February 2010. During step Ia, the company identified a total of eight plants, some of which achieved and failed to achieve the 2009 safety target rates for each of the three safety performance indicators: OSHA, LTA, and severity rates. The plants were also selected on the basis of geographical location and safety expenditure data, not provided to the researcher. The company discussed unexplained variations in safety outcomes among the eight plants and the desire to assess the safety culture at each of the plants using the modified dissertation instrument.

Step IIa.

During step IIa, the researcher reviewed several instruments of safety culture. After working with safety and human resources managers at the company to determine the dimensions to be assessed, the researcher decided to administer the *Questionnaire of Safety Culture Values and Practices* (Díaz-Cabrera et al., 2007). The exploratory factor analysis was conducted on the modified dissertation instrument and compared to the EFA of the original, validated dissertation instrument. A discussion of the EFA will follow in the instrumentation section.

Step II b.

Step II b complied with data collection and analysis procedures as outlined by the Institutional Review Board (IRB) for human subjects protection. (See Appendix E). This study design ensured that the employer could not connect any participant's names to their perceptions. The designated proctors administered the *Questionnaire of Safety Culture Values and Practices* at each of the eight plants and then collected the questionnaires in an envelope, which was sealed to maintain total anonymity. Each employee participated in this research voluntarily and was

instructed not to write his or her name on the survey. Confidentiality of the participants' responses was maintained throughout the research project and individual responses were not and will not be released to the company.

Participants could withdraw their consent and stop participation at any time without consequences. Further, the demographic questions were optional. Completed questionnaires were sent directly to Evie Chenhall at Colorado State University for analysis immediately upon completion. Graduate Research Assistants inputted data into the Statistics 18 software.

Step III.

During step III, the researcher analyzed the combination of the difference and associational research questions. Exploration of the first research question involved analyzing the differences among the plants based on the results of the One-Way ANOVA for the five safety culture value and practices scores. Thereafter, research question two was subdivided into three questions based on plant classification of whether their three 2009 safety goals were achieved. The results of the independent *t*-tests were to compare the safety culture values and practices scores across the plants that achieved and failed to achieve 2009 safety goals for OSHA, LTA, and severity.

Additionally, the five safety culture values and practices scores were compared across geographic region for research question three. Finally, regression was run to determine if a combination of the safety culture values and practices scores were predictive of 2009 OSHA, LTA, and severity rates. Research question five was subdivided into three questions regarding differences on the safety culture type. To answer the three research questions, *t*-tests were conducted to examine differences among the plants' three safety outcomes and the plants'

averages for each of the four safety culture types. Diaz-Cabrera et al. indicated which questions corresponded with each of the four safety culture types.

Differences among the plants were noted and analyzed for trends. The scores for each dimension were compared across locations as displayed in the discussion section, Table 22. Second, the locations were classified according to whether they achieved or failed to achieve 2009 safety goals for the three performance indicators; the results of the questionnaire were compared. The company described the desired safety culture as that of both goal and policy oriented. Anomalies between plant safety ratings and questionnaire results were detected and described in the discussion section.

Figure 4 below outlines the three steps of the dissertation research study.

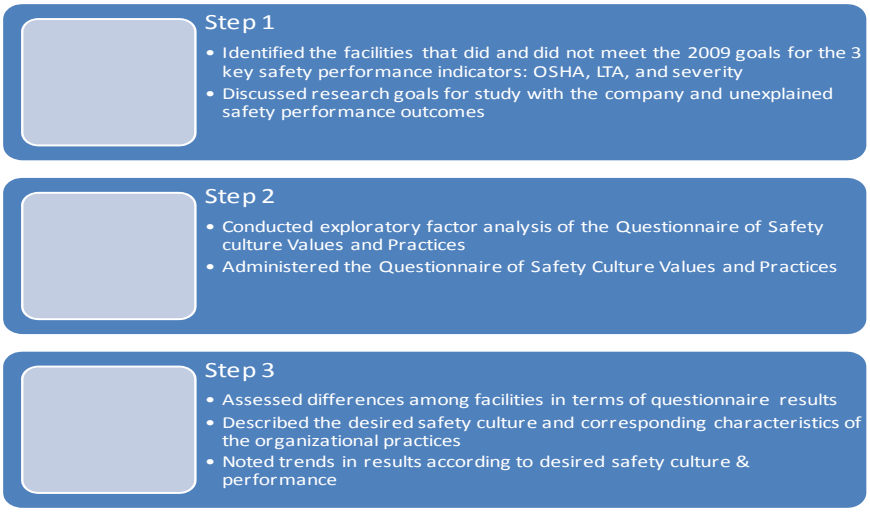

Figure 4. Dissertation Study Procedure

Instrumentation

The instrument was designed to develop a visual representation of an organizational safety culture profile for the five organizational values and practices. (See Appendices F, G, and H). The instrument was comprised of 35 questions and and additional six demographics questions. The results revealed whether each plant has a dominant safety culture type and

identified possible gaps. A comparison was made between Diaz-Cabrera's six indicators of safety culture among the eight plants.

Reliability

Cronbach's Alphas and item factor correlations were used to measure the reliability of the hypothesized factors for this study based on the work of Diaz Cabrera et al. (2007). Table 4 presents the inter-factor correlation matrix among the five factors: company values, leadership style, motivation, communication, and usage of accident information. The highest correlation is between the company values factor and the usage of accident information factor.

Table 4

Inter-Factor Correlation Matrix

Factor	Company Values	Leadership Style	Motivation	Comm.	Usage of Accident Information
Company Values	1.000	.612	.739	.765	.769
Leadership Style	.612	1.000	.675	.622	.561
Motivation	.739	.675	1.000	.655	.614
Communication	.765	.622	.655	1.000	.644
Usage of Accident Information	.769	.561	.614	.644	1.000

The Cronbach's Alphas for each of the scales were at least .839 and above, which is considered to be a high level of reliability as presented in Table 5 (Morgan, Leech, Gloeckner, & Barrett, 2007). Diaz Cabrera (2007) used Cronbach's Alpha to measure the internal consistency reliability of the original instrument in Spanish and English to ensure the proper grouping of factors (Huck, 2008).

Table 5

Reliability Statistics By Factor

Factors	Cronbach's Alpha
Company Values	.940
Leadership Style	.934
Motivation	.911
Communication	.884
Usage of Accident Information	.839

Field Test

Because the instrument was originally written in Spanish, the researcher modified it at the request of the company so that employees at the undisclosed company could understand each of the statements. Field tests as described in the data collection procedures were conducted for validity and reliability purposes to ensure question clarity specific to the population. Several seasoned managers in safety and human resources within the company and the industry reviewed the questions as content experts to verify the appropriateness of the questions for measuring safety culture.

Eleven questions were eliminated and others reworded due to low factor loadings and to the complex nature of questions with multiple constructs.

The following presents one question that was eliminated:

1. Question 30 on the original instrument: "Defines, plans, coordinates aim; motivates subordinates to achieve aims; acknowledges achievement."

The following questions were reworded:

2. Question 4 was restated as "values employee compliance with safety policies and

procedures" rather than "values rules fulfillment."

3. Question 17 was restated as "follow" rather than "observe" so that it is clear that the question is about abiding by safety policies and procedures.

4. Question 39: was reworded as "Department provides clear performance expectations through explaining policies and procedures." Originally, it was worded as, "The department cares about satisfaction with performance criteria, for example: clarity of policies and procedures

5. Question 40 was reworded as "Department provides well-defined work goals rather than "the Department cares about satisfaction with work goals, for example: goals are well-defined."

Exploratory Factor Analysis

Exploratory Factor analysis (EFA) was utilized to examine the dimensions of safety culture as measured by the Questionnaire of Safety culture values and practices (Diaz-Cabrera et al., 2007). Considering that the questionnaire was validated in European industries, the researcher partnered with human resource and safety managers in this undisclosed company in the U.S. to modify items using language specific to the participants in this study. Additionally, EFA was requisite for determining the measurement validity of the instrument given industry and sample size differences between the original validation study (n=299) and this dissertation study (n= 1,291). The researcher compared 32 items from the original validated instrument with the subsequent 24 items from the EFA of the modified dissertation instrument.

The component factor analysis method chosen for this study was principal component analysis because the instrument was recently validated in 2007 and has not been used in other studies (Suhr, 2003). The researcher applied this instrument to a larger sample to determine if the

items would be grouped according to the same factors as the validated instrument (Marcoulides, 1998). The researcher considered both contextual and statistical factors. The EFA resulted in five factors, the same number as the original validated instrument contained after the training programs factor was eliminated.

The following tests and standards guided the factor analysis method for this study. To examine the appropriateness of the factor structure, the Principal Components Analysis with varimax rotation was conducted in Statistical Package for the Social Sciences (SPSS) on 24 items and resulted in five factors with an eigenvalue of greater than one (determinant= 1.09 E-009; KMO= .968; Bartlett= $\chi^2(231)=25795.222$, p=.01). Table 6 displays the Rotated Component Matrix.

The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was conducted. In factor selection, Kaiser's criterion or the eigenvalue rule (of 1.0 or greater) and the scree plot test were used. Finally, the number of variables representing each common factor required a minimum of three variables per factor and a minimum factor loading of .40 per item to be included in the factor.

Table 6

Rotated Component Matrix[a]

Factors	Component				
	1	2	3	4	5
Company Values (Q4)	**.743**	.279	.206	.140	.207
Company Values (Q5)	**.779**	.219	.198	.215	.195
Company Values (Q6)	**.751**	.219	.183	.274	.231
Company Values (Q7)	**.732**	.244	.197	.237	.259
Company Values (Q16)	**.543**	.436	.170	.351	.149
Company Values (Q17)	**.518**	.480	.174	.388	.151
Company Values (Q18)	**.539**	.471	.204	.389	.175
Company Values (Q19)	**.496**	.539	.201	.316	.175
Usage of Accident Info (Q8)	.606	.240	.199	.223	**.447**
Usage of Accident Info (Q9)	.329	.187	.128	.222	**.731**
Usage of Accident Info (Q10)	.206	.206	.171	.077	**.799**
Usage of Accident Info (Q11)	.381	.266	.253	.244	**.546**
Communication (Q20)	.372	**.666**	.269	.228	.144
Communication (Q21)	.221	**.778**	.230	.170	.181
Communication (Q22)	.249	**.740**	.238	.191	.198
Communication (Q23)	.226	**.692**	.235	.187	.210
Leadership Style (Q24)	.232	.268	**.764**	.223	.117
Leadership Style (Q25)	.217	.209	**.831**	.261	.156
Leadership Style (Q26)	.155	.217	**.833**	.223	.191
Leadership Style(Q27)	.203	.234	**.809**	.285	.131
Motivation Patterns (Q28)	.347	.253	.299	**.671**	.107
Motivation Patterns (Q29)	.284	.190	.272	**.787**	.134
Motivation Patterns (Q30)	.257	.292	.318	**.707**	.195
Motivation Patterns (Q31)	.221	.215	.288	**.763**	.194

Note: Extraction Method: Principal Component Analysis; Rotation Method: Varimax with Kaiser Normalization

[a] Rotation converged in 7 iterations.

Table 7 shows the factor loadings, the percentage of total variance explained by factors, the internal consistency of factors, and the corrected item-total correlations. Appendix I presents a comparison of the exploratory factor analysis for the original validated instrument and the modified dissertation instrument according to the variance explained by each factor, factor loadings, Cronbach's Alpha, and corrected item total correlations.

Table 7

Factor Loadings, Total Variance Explained by Factors, Reliability, and Corrected Item Total Correlations

MODIFIED DISSERTATION INSTRUMENT			
	Factor Loadings	Cronbach's Alpha	Corrected Item Total Correlation
Factor 1: Company Values (20.021%)		0.940	
(Q4) Values employee compliance with safety policies and procedures	0.743		0.766
(Q5) Values honesty of all employees in collecting info about incidents and accidents	0.779		0.785
(Q6) Values collaboration in goals achievement	0.751		0.795
(Q7) Values initiative in indentifying new solutions to improve safety	0.732		0.790
(Q16)Values participation in safety promotion	0.543		0.772
(Q17) Values employees that follow safety policies and procedures to promote safety	0.518		0.792
(Q18) Values the contribution of creative ideas to improve safety	0.539		0.813
(Q19) Values goals achievement	0.496		0.779
Factor 2: Leadership Styles (16.233%)		0.934	
(Q24) Shows the safe way to perform my job duties	0.750		0.793
(Q25) Analyzes unsafe behavior to determine the cause	0.820		0.880
(Q26) Warns about possible penalties when I perform my job in an unsafe manner	0.830		0.853
(Q27) Discusses most appropriate solution to prevent unsafe behavior	0.800		0.853

MODIFIED DISSERTATION INSTRUMENT			
	Factor Loadings	Cronbach's Alpha	Corrected Item Total Correlation
Factor 3: Motivation Patterns (15.221%)		0.911	
(Q28) Department encourages teamwork and cooperation between employees and managers	0.610		0.770
(Q29) Department cares about employees' job satisfaction	0.720		0.824
(Q30) Department provides clear performance expectations through explaining policies and procedures	0.650		0.810
(Q31) Department provides well-defined goals	0.800		0.800
(Q32) Work goals are specific, achievable, and realistic	0.790		0.730
(Q33) Variety in job duties	0.470		0.570
(Q34) Satisfied with the cooperation between employees and managers in my work group	0.660		0.770
(Q35) Satisfied with my performance expectations	0.670		0.750
Factor 4: Communication (14.329%)		0.884	
(Q20) Communication among employees and supervisors about safety	0.600		0.750
(Q21) Communication of safety goals	0.680		0.690
(Q22) Formal communication of safety policies and procedures	0.650		0.700
(Q23) Usually communication among employees to identify solutions to improve safety	0.560		0.670
Factor 5: Usage of Accident Information (9.627%)		0.839	
(Q8) Changes in work procedures based on employee solutions to improve safety	0.447		0.740
(Q9) Revision of work goals	0.731		0.630
(Q10) Information about consequences of breaking safety policies and procedures	0.799		0.530
(Q11) Identification of training needs	0.546		0.700
(Q26)Moved to leadership factor 2: The immediate supervisor warns about possible penalties			

Internal Validity

Gliner and Morgan (2009) outline the criteria for internal validity of the study design. Employees at each plant were not randomly selected to participate; however, employees from the same divisions and job classifications were sampled at each plant so that demographic comparisons could be made. Employees that voluntarily completed the demographic section indicated their job and company tenure as to account for differences in participant dimensions. Therefore, the researcher rated the equivalence of groups as medium. Figure 5 presents the sampling plan and sampling design. As a non-experimental study, the control of extraneous experiences and environmental variables was low given the researcher's lack of control over each plant's safety practices and interventions. The researcher controlled for regional culture differences through inclusion of plants from each of the geographic regions. All of the plants have relatively homogeneous manufacturing processes.

External Validity

The sampling plan and design are presented in Table 8 showing the frequency and percentages of the participants in the specified positions related to safety. The adequacy of the sampling method was low because this study did not include a randomized sample of participants in the organization despite a 61.21% response rate (Gliner et al., 2009). Furthermore, the results of this study cannot be generalized outside the organization. The ecological validity was rated as medium because of the use of a questionnaire.

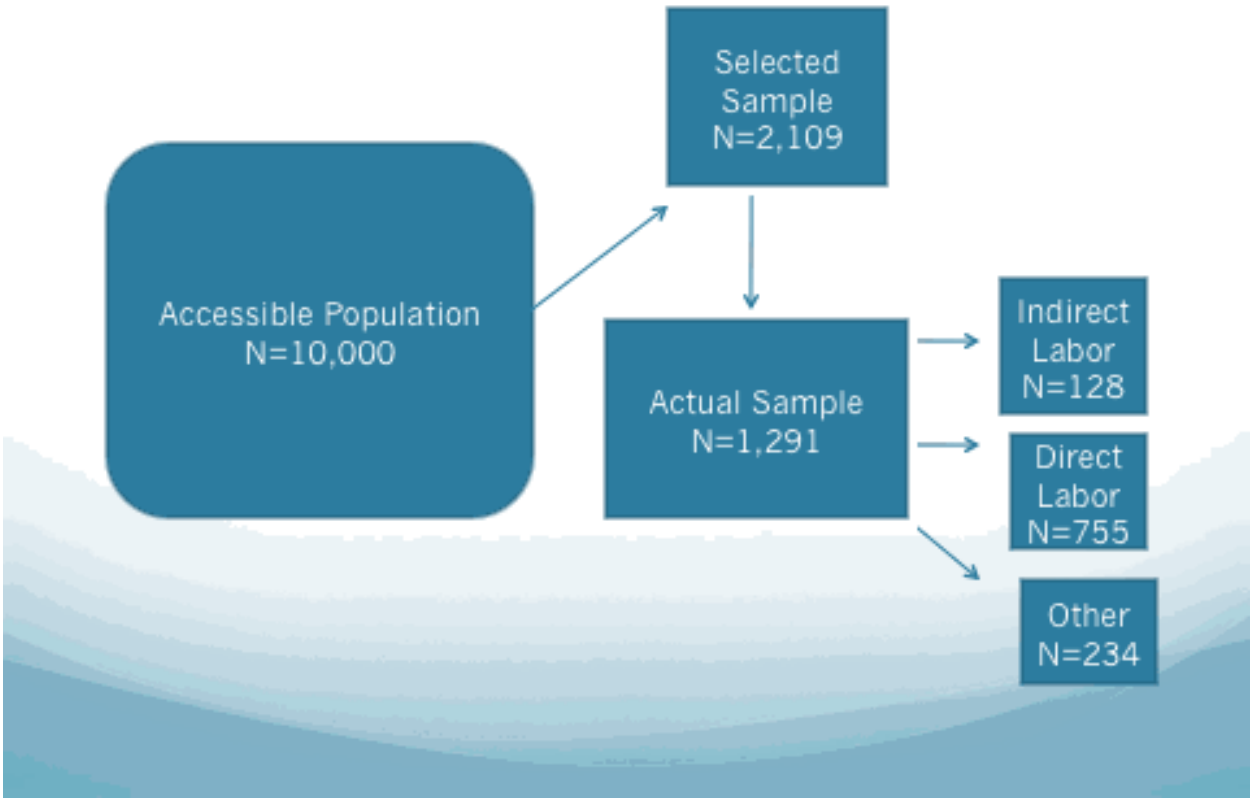

Figure 5. Sampling Design of the selected and actual sample in this study. There were 174 employees that did not indicate their position.

Table 8

Completed Surveys by Total Employees Crosstabulation

Plant	Completed Surveys	Total Employees by Plant in Safety-Related Positions [a]	
1	169	340	49.71%
2	79	146	54.12%
3	307	360	85.28%
4	189	304	62.17%
5	296	390	75.90%
6	74	123	60.16%
7	104	231	45.02%

Plant	Completed Surveys	Total Employees by Plant in Safety-Related Positions [a]	
8	73	215	33.95%
Total	1291	2109	61.21%

[a] 4 specified job classifications

Note. There were 174 employees that did not indicate their position.

Measures

The instrument was designed to assess the following: "company values, safety standard procedures and policies, motivation, organizational communications system, and leadership style" (Díaz-Cabrera, 2007, p. 1207). Cameron and Quinn's *Competing Values Framework* (2006) applied to safety "reflect" four culture types including: support, innovation, goals, and policies (Diaz-Cabrera et al., p. 1204). The *Questionnaire of Safety Culture Values and Practices* was developed to measure four safety culture types based on five safety-related organizational practices.

The Questionnaire *of Safety Culture Values and Practices,* referenced in Appendices F, G, and H consisted of four sections and is based on a seven-point Likert scale ranging from Disagree to Agree. Each item has a Likert response scale of 7 points to reflect the degree of agreement, satisfaction, and frequency of each. The first section presents a brief description of the project and specific instructions on how to complete the questionnaire. The second section contains questions pertaining to company information and job specific questions. The third section is comprised of 35 items about the organizational values, leadership style, motivational patterns, communication, safe behavior promotion, use of information about incidents and accidents, and motivation patterns questions. Demographic data consisting of employee tenure and job classification were included.

Below is a description of each dimension of the *Questionnaire of Safety Culture Values and Practices* instrument.

- *Dimension 1: Company Values* "Reflects the perceptions of employees about those aspects specifically related to safety management the company considers to be relevant. These aspects are related to the incident and accident reporting system and the safety promotion strategies.
- *Dimension 2: Leadership Style* "Reflects the perceptions of employees about the behavioral style of the immediate supervisor including, whether the immediate supervisor "shows how to perform job duties safely when employees act in an unsafe manner; analyzes the unsafe behavior to determine the cause; corrects and reminds employees of possible penalties; discusses with employees the most appropriate solution to prevent the unsafe behavior in the future."
- *Dimension 3:Motivation patterns* "Reflects the perceptions of employees concerning the degree to which the company is concerned about their employees' satisfaction with different aspects of their job, for example: job satisfaction, satisfaction with the work team, with the performance criteria, and work goals"
- *Dimension 4: Communication* "Reflects the perceptions of workers concerning the type of safety information provided for workers from the upper levels. For example: formal communication about safety rules and procedures, and safety aims."
- *Dimension 5:Usage of accident information* "Reflects the perceptions of workers concerning the degree and type of usage of incident and accident information by the company, i.e., informing about safety rules and procedures fulfillment, detecting

training needs, developing changes in work procedures, and revising work goals" (Diaz-Cabrera, 2007).

General Demographics

A total of 1,117 employees responded to the second demographics question. Of that total, 67.6% were hourly employees while 27.1% were first line supervisors and 20.9% reported other (n=174 missing). Approximately 36.7% of the total 1,096 respondents for question three have worked for the company 20 years or more, and 19.3% have worked for the company between five to ten years (n=195 missing) as shown in Figure 6. The majority of the 1,173 respondents who answered question five work 12-hour shifts (53.9%) as shown in Figure 7. A total of 1,144 respondents answered question 6, of which 58.7% work rotating shifts.

The following questions provide the frequency of responses for questions that were not included in the analysis of the scale, but provided insightful information in the interpretation of the scale scores. The following received the most "Strongly Agree" responses.

Question 2: "My co-workers and I report incident and accidents, even if it interferes with achieving work goals." (388 responses)

- Question 4: "I feel that *name of company* values employee compliance with safety policies and procedures." (481 responses)
- Question 28: "My department encourages teamwork and cooperation between employees and managers." (290 responses)

  Question 33: "I have variety in my job duties. (401 responses)

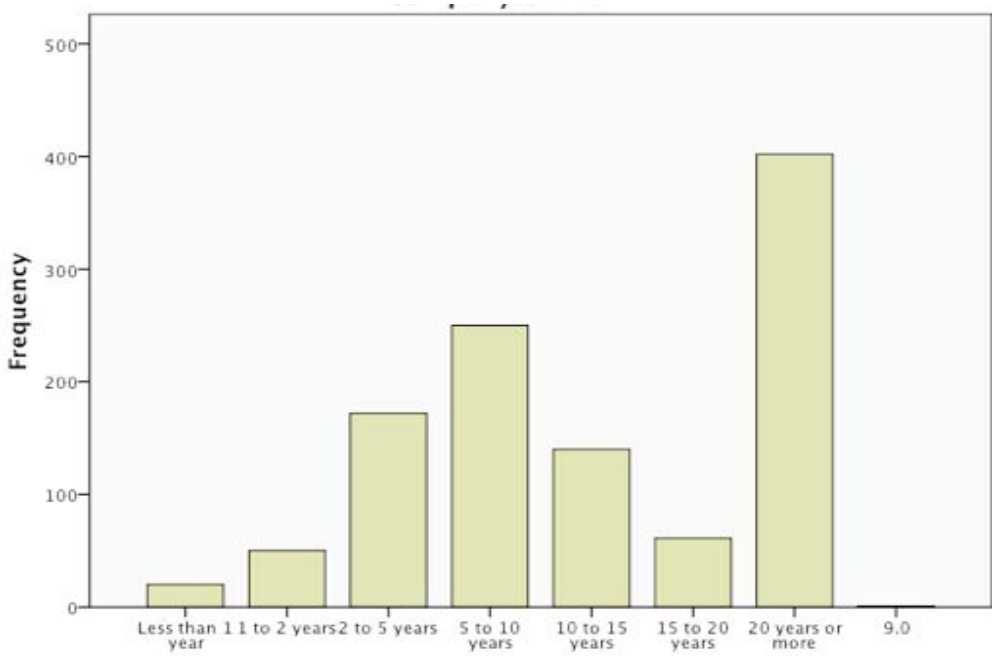

Figure 6. Company tenure of survey participants is shown. There were 195 employees that did not indicate a response regarding company tenure.

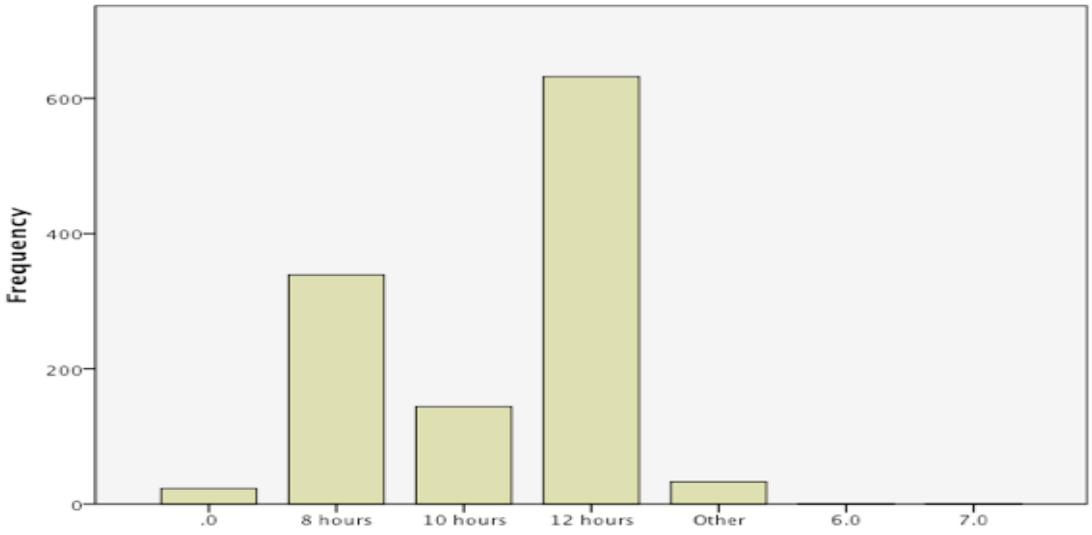

Figure 7. Frequency of Employees By Work Shift indicated as 8 hours, 10, hours, 12 hours, or other.

Question 1: “My co-workers and I report only serious incidents and accidents, not the less serious incidents and accidents.”

Table 9
Plant by Q1 Crosstabulation

Plant	Strongly Disagree	Generally Disagree	Slightly Disagree	Neutral	Slightly Agree	Generally Agree	Strongly Agree	
1	47	46	11	22	15	20	8	169
2	23	20	8	3	7	16	2	79
3	114	60	29	13	26	36	28	306
4	29	32	19	17	29	49	13	188
5	87	75	25	20	39	37	13	296
6	22	13	2	10	3	12	11	73
7	30	13	9	10	14	23	5	104
8	26	22	2	3	8	10	2	73
Total	378	281	105	98	141	203	82	1288

Table 10

Intentions for Answering Research Questions

Research Questions	Statistical Analyses	Rationale for Statistic Selection
1. Are there differences among the eight plants on the average of the summated safety culture values and practices scores?	One-Way ANOVA	• "Make a single inferential statement concerning the means of the study's populations (Huck, 2008, p. 260)
2. Are there differences between the plants that did not meet safety goals and met safety goals safety outcomes in regard to the average of the summated Culture Values and Practices scores? a.) Are there differences between the plants that did and did not meet 2009 safety goals for OSHA rates in regard to the average of the summated Culture Values and Practices scores? b.) Are there differences between the plants that did and did not meet 2009 safety goals for LTA rates in regard to the average of the summated Culture Values and Practices scores? c.) Are there differences between the plants that did and did not meet safety goals for severity rates in regard to the average of the summated Culture Values and Practices scores?	Independent t-Test	• Two levels of the independent variable (achieved safety goals versus failed to achieve safety goals)
3. Are there differences in the average of the summated safety culture values and practices scores by geographic region?	Independent t-Test	• Two levels of the independent variable (did not meet safety goals versus met safety goals)

Research Questions	Statistical Analyses	Rationale for Statistic Selection
4. Research Question Four: How well do the individual and combined Safety Culture Values and Practices score predict the 2009 safety outcomes by plant? a.) How well do the individual and combined Safety Culture Values and Practices score predict the 2009 OSHA recordable rates by plant? b.) How well do the individual and combined average of each safety Culture Values and Practices score predict the 2009 LTA rates by plant? c.) How well do the individual and combined Safety Culture Values and Practices score predict the 2009 severity rates by plant?	Multiple Regression	Used stepwise regression and the enter method as "an exploratory procedure" (Gliner, Morgan, and Leech, 2009)
5. Are there differences between the plants that did not meet safety goals and met safety goals safety outcomes in regard to the average of the summated Safety culture type? a.) Are there differences between the plants that did not meet safety goals and met safety goals 2009 OSHA rates in regard to the average of the summated Safety culture type? b.)Are there differences between the plants that did not meet safety goals and met safety goals 2009 LTA rates in regard to the average of the summated Safety culture type? c.)Are there differences between the plants that did not meet safety goals and met safety goals 2009 severity rates in regard to the average of the summated Safety culture type?	Independent t- Test	• More than one independent variable (Leech, Barrett, & Morgan, 2005)

CHAPTER FOUR: RESULTS

Introduction

Chapter four summarizes the analysis of the questions and responses from the *Organizational Culture Practices and Values Questionnaire* consisting of 35 items with 8 optional demographics questions. Twenty-four questions were included in the analysis. If more than one response was indicated per question, the researcher randomly selected a single response for the analysis based on the two selections. The questionnaire items were on a scale of one to seven ranging from strongly disagree to strongly agree. If two responses were selected for demographics questions, then the response with the greater level of responsibility or more time with the company was entered into the database. If more than one work shift was provided, then *other* was selected. Blank responses were coded as 99 indicating that they were missing in the SPSS Statistics 18 software.

There were only six cases where more than half of the items within a scale were left blank and thus excluded from analysis. The researcher explored several options in handling missing items for the remainder of the questions where less than half of the items in a scale were left blank. Regardless of whether missing items were replaced by the scale mean or excluded from analysis made no discernable difference in the scale scores. The results presented in this chapter are the average of the summated scores for each company scale.

Research Question One

Are there differences among the eight plants on the average of the summated safety culture values and practices scores?

Research question 1 examined whether there were differences in employee mean scores on the Diaz-Cabrera et al. (2007) Questionnaire of Safety Culture Values and Practices by plant. To answer this question, a one-way analysis of variance (ANOVA) was used to compare significant differences among eight plants on the five dependent variables of the safety culture values and practices mean scores. As noted in Table 4.1 of the safety culture values and practices mean scores indicated significant differences among the eight plants as follows: company values $F(7, 1272)=26.066$, $p = < .001$, leadership style $F(7, 1268)=10.317$, $p < .001$, motivation $F(7, 1271)=15.219$, $p = < .001$, communication $F(7,1278)=17.002$, $p <.001$, usage of accident information $F(7, 1281)=18.039$, $p< .001$.

Table 11

One-Way Analysis of Variance (ANOVA) Summary Table Comparing Plants to the Safety Culture Values and Practice Factors

Source	*df*	SS	MS	*F*	*p*
Company Values					
Between Groups	7	228.871	32.696	26.066	< .001
Within Groups	1272	1595.542	1.254		
Total	1279	1824.413			
Leadership Style					
Between Groups	7	135.199	19.314	20.317	< .001
Within Groups	1268	2373.866	1.872		
Total	255	2509.085			
Motivation					
Between Groups	7	194.672	27.810	15.219	< .001
Within Groups	1271	2322.557	1.827		
Total	1278	2517.229			
Communication					
Between Groups	7	143.438	20.491	17.002	< .001
Within Groups	1278	1540.265	1.205		
Total	1285	1683.703			

Table 11–Continued

One-Way Analysis of Variance (ANOVA) Summary Table Comparing Plants to the Burke-Litwin OAS Factors

Source	*df*	SS	MS	*F*	*p*
Usage of Accident Information					<.001
Between Groups	7	162.729	23.247	18.039	
Within Groups	1281	1650.863	1.289		
Total	1288	1813.592			

Results of Games-Howell Post Hoc Multiple Comparison Test

The homogeneity of variance Levene test indicated that the variances among the safety culture values and practice factors were statistically significant ($p<.05$). As a result, the Games-Howell post hoc test was conducted. The calculated effect sizes (*d*) were reported. Table 12 shows the means, standard deviations, and significant differences between the eight plants according to the mean safety culture values and practices score. The plants with the highest and lowest means by factor were noted. Plant 6 had significantly lower Safety culture values and practices scores than most of the other plants on each of the five dimensions. Plant 3 had the highest mean of the summated scores for leadership and communication. Plant 8 had the highest mean scores for company values, motivation, and usage of accident information.

Table 12

Means, Standard Deviations, and Significant Differences Among Plants and Safety Culture Values and Practices Factors

Factor	Plant #1			Plant #2			Plant #3			Plant #4			Plant #5		
	n	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*
Company Values	69	5.207 $_{3,5,6,8}$	1.171	79	5.658 $_{6}$	1.094	304	5.999 $_{1,4,6,7}$	1.029	182	5.227 $_{3,5,6,8}$	1.129	295	5.749 $_{1,4,6,7,8}$	1.014
Leadership Style	69	4.811 $_{2,3,5}$	1.483	78	5.378 $_{1,4,6}$	1.043	302	5.559 $_{1,4,6}$	1.300	185	4.760 $_{2,3,5}$	1.430	294	5.271 $_{1,4,6}$	1.232
Motivation	69	4.719 $_{3,5,8}$	1.405	78	4.930 $_{3}$	1.538	306	5.576 $_{1,4,6,7}$	1.307	186	4.647 $_{3,5,8}$	1.404	295	5.340 $_{1,4,6,7}$	1.182
Comm.	69	5.438 $_{3,5,6,8}$	1.031	78	5.756 $_{6}$	.959	306	5.965 $_{1,4,6,7}$	1.077	187	5.34 $_{3,5,6,8}$	1.175	296	5.776 $_{1,4,6,7}$	.914
Usage of Accident Information	69	5.104 $_{3,5,8}$	.771	79	5.399 $_{3,6,8}$	.805	307	5.803 $_{1,4,6,7}$	.768	189	5.187 $_{3,68}$	.637	295	5.510 $_{1,3,4,6,8}$	.605

Note. Common subscripts in each row indicate significant differences between means, $p < .05$ using Games Howell post hoc.
For example, the mean shown for plant 1 is 5.207 for company values. This mean differed significantly from plants 3, 5, 6, 8 as indicated by the subscript numbers.

Table 12-Continued

Means, Standard Deviations, and Significant Differences Among Plants and Safety culture values and practices Factors

		Plant #6		Plant #7			Plant #8			Total	
Factor	n	M	SD	*n*	*M*	*SD*	*n*	*M*	*SD*	*M*	*SD*
Company Values	74	4.474 [1,2,3,4,5,7,8]	1.650	104	5.278 [3,5,6,8]	1.295	73	6.111 [1,4,5,6,7]	.780	5.566	1.194
Leadership Style	73	4.525 [2,3,5]	1.704	102	5.103	1.504	73	5.168	1.460	5.149	1.403
Motivation	71	4.633 [3,5,8]	1.575	103	4.767 [3,5,8]	1.519	71	5.589 [1,4,6]	1.213	5.117	1.403
Communication	74	4.735 [1,2,3,4,5,8]	1.513	103	5.218 [3,6,8]	1.433	73	5.843 [1,4,8]	.891	5.611	1.145
Usage of Accident Information	74	4.519 [2,3,4,5,8]	1.599	104	5.149 [3,8]	1.186	72	5.955 [1,2,4,5,6,7]	.862	5.411	1.187

Note. Common subscripts in each row indicate significant differences between means, $p < .05$ using Games Howell post hoc.
For example, the mean shown for plant 1 is 5.207 for company values. This mean differed significantly from plants 3, 5, 6, 8 as indicated by the subscript numbers.

Company Values. As shown in Table 12, plant 8 (*M=6.111)* had the highest mean scores in company values and plant 6 (*M=4.474)* had the lowest mean score based on the Likert scale of 1 to 7. Plant 6 had a significantly lower mean score in company values than the other 7 plants. The effect sizes varied from small to large for the company values scores.

Leadership Style. As shown in Table 12, plant 3 had the highest mean score for leadership style (*M*=5.559) and plant 6 had the lowest mean (*M*=4.525*)* based on the Likert scale of 1 to 7. Plants 7 and 8 did not have any statistically significant differences from the other plants.

Motivation. As shown in Table 12, plant # 8 had the highest mean score for motivation (*M*=5.589) and plant 6 had the lowest mean (*M*=4.633) based on the Likert scale of 1 to 7.

Communication. As shown in Table 12, plant # 3 had the highest mean score for communication (*M*=5.965*)* and plant 6 had the lowest mean (*M*=4.735) based on the Likert scale of 1 to 7.

Usage of Accident Information. As shown in Table 12, plant # 8 had the highest mean (*M*=5.955) and plant 6 had the lowest mean score (*M*=4.519) for usage of accident information based on the Likert scale of 1 to 7. All of the plants differed significantly from # 6 (*M*=4.735) on usage of accident information scores with the exception of plants #1 and #7. All of the plants differed significantly from # 8 (M=5.955) except plant #3.

Research Question Two

Are there differences between the plants that did and did not meet the 2009 safety goals in regard to the average of the summated Culture Values and Practices scores?

Sub-questions:

2a.) Are there differences between the plants that *achieved and failed to achieve 2009 safety goals* for *OSHA* rates in regard to the average of the safety summated culture values and practices scores?

2b.) Are there differences between the plants that *achieved and failed to achieve 2009 safety goals* for *LTA* rates in regard to the average of the safety summated culture values and practices scores?

2c.) Are there differences between the plants that *achieved and failed to achieve safety goals* for *severity* rates in regard to the average of the summated safety culture values and practices scores?

Research question two was subdivided into three questions. To answer the three research questions, t-tests were conducted to examine differences among the plants three safety outcomes and the plants' averages for each of the five summated safety culture values and practices scores. The five dependent variables were company values, leadership style, motivation, communication, and usage of accident information scores. The independent variables included the plants' OSHA, LTA, and severity rates.

The plants were classified according to those that *achieved and failed to achieve safety goals* according to the three safety performance indicators. The dependent variables were normally distributed, and the Levene test indicated that the two groups met the assumption of equal variances.

Table 13 shows plants that *achieved* and those that *failed to achieve 2009 safety goals* for OSHA recordable rates. Tables 16 and 17 indicated that LTA and severity rates did not differ significantly in regard to their safety culture values and practices scores. The scores and the

OSHA rates had small effect sizes, whereas all the scores and severity rates had large effect sizes. The scores and LTA rates had small, medium, and large effect sizes.

Table 13

Summated Means and Standard Deviations of Safety Culture Values and Practices Scores by Plants That Achieved and Failed to Achieve 2009 OSHA Goals

	Achieved OSHA Goals (n=4 plants)		Failed to Achieve OSHA Goals (n=4 plants)					
Factor	*M*	*SD*	*M*	*SD*	*t*	*df*	*p*	*d*
Company Values	44.184	3.037	43.223	5.658	.299	6	.775	.212
Leadership Style	20.508	1.607	19.998	1.426	.475	6	.652	.336
Motivation	19.871	1.690	20.315	1.844	-.355	6	.735	.251
Communication	22.501	1.152	21.571	2.082	.782	6	.464	.553
Usage of Accident Information	21.492	1.245	21.133	2.427	.263	6	.802	minimal

Table 14

Summated Means and Standard Deviations of Safety Culture Values and Practices scores by Plants That Achieved and Failed to Achieve 2009 LTA Goals

	Achieved LTA Goals (n=5 plants)		Failed to Achieve LTA Goals (n=3 plants)					
Factor	*M*	*SD*	*M*	*SD*	*t*	*df*	*p*	*d*
Company Values	45.125	3.369	41.333	5.157	1.281	6	.247	.871
Leadership Style	20.541	1.394	19.774	1.658	.706	6	.507	.501
Motivation	20.368	1.838	19.634	1.523	.578	6	.584	.435
Communication	22.675	1.071	20.971	2.084	1.568	6	.168	1.028
Usage of Accident Information	21.957	1.501	20.238	2.010	1.396	6	.212	.969

Table 15

Means of Summated Scores and Standard Deviations of Safety Culture Values and Practices Scores by Plants That Achieved and Failed to Achieve 2009 Severity Goals

	Achieved Severity Goals (n=3 plants)		Failed to Achieve Severity Goals (n=5 plants)					
Factor	*M*	*SD*	*M*	*SD*	*t*	*df*	*p*	*d*
Company Values	20.610	2.455	23.067	1.617	-1.737	6	.133	1.182
Leadership Style	19.595	1.769	20.713	1.128	-1.113	6	.308	.754
Motivation	18.976	.703	20.733	.788	-1.958[a]	5.586[a]	.101	2.353
Communication	21.423	1.789	22.528	1.326	-1.011	6	.351	.702
Usage of Accident Information	20.166	1.565	22.091	1.425	-1.790	6	.124	1.286

[a] The *t* and *df* were adjusted because variances were not equal.

Research Question Three

Are there differences in the average of the summated Safety culture values and practices scores by geographic region?

Research question 3 was designed to measure differences in the Safety culture values and practices scores between the plants in two geographic regions. To answer this research question, a t-test was conducted to examine the differences among the five summated scores on Safety culture type and geographic location. The five dependent variables were company values, leadership style, motivation, communication, and usage of accident information scores. The independent variables were the two geographic regions.

As noted in Table 16, the four plants in the first geographic region did not differ significantly from the four plants in the second geographic region in terms of their average summated safety culture company values and practices scores.

Table 16

Means and Standard Deviations of Safety culture values and practices scores By Plants in Two Geographic Regions

	Geographic Location 1 (n=3 plants)		Geographic Location 2 (n=5 plants)					
Factor	*M*	*SD*	*M*	*SD*	*t*	*df*	*p*	*d*
Company Values	21.251	3.407	22.683	1.301	-.877	6	.414	.555
Leadership Style	19.314	1.323	20.881	1.182	-1.743	6	.132	1.249
Motivation	19.851	2.177	20.210	1.369	-.272	6	.795	minimal
Communication	21.540	1.947	22.460	1.280	-.822	6	.443	.558
Usage of Accident Information	20.920	2.703	21.640	1.080	-.554	6	.600	.350

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Research Question Four

How well do the combined safety culture values and practices scores predict the 2009 safety performance by plant?

Sub-questions:

a.) How well do the individual and combined safety culture values and practices scores predict the 2009 OSHA recordable rates by plant?

b.) How well do the individual and combined averages of each safety culture values and practices scores predict the 2009 LTA rates by plant?

c.) How well do the combined safety culture values and practices scores predict the 2009 severity rates by plant?

The predictor variables were company values, leadership style, motivation, communication, and usage of accident information. The dependent variables included OSHA, LTA, and severity rates. Research question four was subdivided into three research questions. Multiple regression was conducted using the backward and forward stepwise methods to determine whether the OSHA, LTA, and severity rates could be predicted from the average of the summated Safety culture values and practices scores. The safety culture values and practices scores were aggregated at the plant level, and the means, standard deviations and inter-correlations can be found in Table 17. The variables were entered in the following order: Usage of accident information, leadership style, motivation, communication, and company values were entered. Motivation and usage of accident information were eliminated. The final model actually did not include any variables. Furthermore, the combined Safety culture values and practices scores did not predict 2009 OSHA, LTA, and severity rates.

Table 17

Multiple Regression:Means, Standard Deviations, and Intercorrelations for OSHA, LTA, and Severity Rates and Predictor Variables (n=8)

Safety Outcome Variables	M	SD	Usage of Accid. Info	Leadership Style	Motivation	Comm.	Company Values
OSHA rates	9.63	6.802	.262	-.095	.214	-.143	.143
LTA rates	2.75	2.659	-.024	-.277	-.096	-.374	-.108
Severity rates	136.35	148.963	.433	.096	.359	.132	.395
Predictor Variables							
Company Values	5.4629	.52937		.810*	.976**	.881**	.976**
Leadership Style	5.0718	.34749	.810*		.833*	.833*	.762*
Motivation	5.0249	.41171	.976**	.833*		.905**	.929**
Comm.	5.5090	.40873		.833*	.905**		.905**
Usage of Accident Information	5.3281	.44924		.762*			

*$p<.05$ **$p<.001$

Research Question Five

Are there differences between the plants that achieved and failed to achieve 2009 safety goals in regard to the average of the summated safety culture type scores?

Sub-questions:

a.) Are there differences between the plants that *achieved and failed to achieve* 2009 safety goals for *OSHA* rates in regard to the average of the summated safety culture type scores?

b.) Are there differences between the plants that *achieved and failed to achieve* 2009 *safety goals* for *LTA* rates in regard to the average of the summated safety culture type scores?

c.) Are there differences between the plants that *achieved and failed to achieve* 2009 safety goals for *severity* rates in regard to the average of the summated safety culture type scores?

Research question five was subdivided into three questions. To answer the three research questions, t-tests were conducted to examine differences among the plants' three safety outcomes and the plants' averages for each of the four summated safety culture type. The four dependent variables were supportive, innovative, policy-oriented, and goals-oriented culture scores. The independent variables included the plants' OSHA, LTA, and severity rates. The dependent variables were normally distributed, and the Levene test indicated that the two groups met the assumption of equal variances.
The three summated scores were aggregated at the plant level. There were no statistically significant differences between plants that *achieved and failed to achieve* 2009 OSHA,

LTA, and severity goals in regard to the average of the summated safety culture type. The effect sizes for each of the safety culture type summated scores and OSHA rates were minimal with the exception of the policy-oriented culture, which was small (d=.269) according to Cohen (1988). Safety culture type summated scores and LTA had both medium and large effect sizes. All of the safety culture type summated scores and severity rates had large effect sizes of at least 1.509.

CHAPTER FIVE: DISCUSSION

Summary of the Study

The purpose of this study was to identify where safety performance improvements can be made, thus establishing a foundation for further study by the company to formulate specific recommendations within the identified areas. The data were analyzed to determine whether five organizational practices and values described herein were predictors of 2009 safety performance. Accordingly, this non-experimental comparative study examined differences in safety culture dimensions between plants that achieved and failed to achieve their 2009 safety goals.The Competing Values Framework (Quinn & Kimberly, 1984) was adapted to assess safety culture strengths and congruencies among plants as an extension of the work of Silva, et al. (2004) and Diaz Cabrera et al. (2007). Additionally, the underlying values, leadership types, and culture orientations measured through the *Questionnaire of Safety Culture Values and Practices* were tested for the first time as predictors of accident data. Despite considerable research on safety climate and culture predictors of accidents in organizations (Clarke, 2006), "the practical significance of these factors in the prevention of accidents remains undetermined" (Diaz & Diaz Cabrera, 1997, p. 643).

Overview of the problem

The research literature discussed several approaches to developing a positive safety culture. However, most of the research does not classify types of positive safety cultures according to the culture dimensions specific to both values and organizational practices. Despite multiple attempts to explain safety culture through competing models, there is limited empirical

research to substantiate which company values and organizational safety practices have the most demonstrative impact on safety performance at the plant level. For instance, Richter and Koch's (2004) ethnographic study identified three distinct safety cultures, but these culture types were not statistically linked to safety performance.

Instrument Modification

The dimensions of the Safety culture values and practices questionnaire were developed according to research on safety climate, safety management systems, and models of organizational culture. Primarily stemming from the Competing Values Framework and Schein's model of organizational culture, the dimensions this questionnaire are supported by relevant safety culture literature. Other studies have included management style as measures of safety climate (Fernandez-Muniz et al., 2007), recognizing the need to measure how managers and supervisors provided feedback to employees, a consideration in this study.

An exploratory factor analysis (EFA) resulted in five factors, consistent with the original validated instrument. As the first study applying the Questionnaire of *Organizational Culture and Safety Practices*, the results were compared with the original validation study. This study explained approximately 75% of the total variance of the dimensions associated with safety culture, whereas, the original validated instrument accounted for about 55%. The researcher conducted factor analysis on all of the original items on the instrument, including those that were eliminated from the validation study. In this study, eleven questions were eliminated and others reworded due to complex questions with multiple constructs and low factor loadings. Additionally, some eliminated items from the original instrument were included in this study because they were of interest to the company and they loaded well with the existing factors. For

example, “My supervisor warns about possible penalties when I perform my job in an unsafe manner,” was included in this study, but not the original study. The Cronbach’s Alphas for each factor were higher in this study. The comparison table of factor loadings, Cronbach’s Alphas, and corrected item-total correlations are listed in Appendix I.

Overview of the Findings

Research Question One

Are there differences among the eight plants on the average of the summated safety culture values and practices scores?

Investigation of the first research question involved conducting a One-Way ANOVA to analyze significant differences among the eight plants on the five dependent variables of the Safety culture values and practices mean scores. Table 22 and Figure 8 are a graphic representation of the Safety culture values and practices mean for each of the five dimensions. The highest and lowest means for each dimension are highlighted in Table 22.

The significant differences among the eight plants allow the company to pinpoint some of the cultural variations. The company was not surprised when presented with plant 6 data. The company attributed the low scores of plant 6 to leadership and resources. The top performing plants, 3 and 8, had the highest means for the five dimensions. Plants 3 and 8 can be further investigated to establish benchmarks in specific practice areas related to communication, usage of accident information, and safety leadership.

Table 22

Comparison of Mean Safety Culture Scores for the Five Dimensions of the Safety Culture Values and Practices Questionnaire by Plant

Plants	Company Values *M*	Leadership Style *M*	Motivation *M*	Communication *M*	Usage of Accident Information *M*
#1	5.207	4.811	4.719	5.438	5.104
#2	5.658	5.378	4.930	5.757	5.399
#3	5.999	5.559 H	5.576	5.965 H	5.803
#4	5.227	4.760	4.647	5.341	5.187
#5	5.749	5.271	5.340	5.778	5.510
#6	4.474 L	4.525 L	4.633 L	4.735 L	4.519 L
#7	5.278	5.103	4.767	5.218	5.149
#8	6.111 H	5.168	5.589 H	5.843	5.955 H

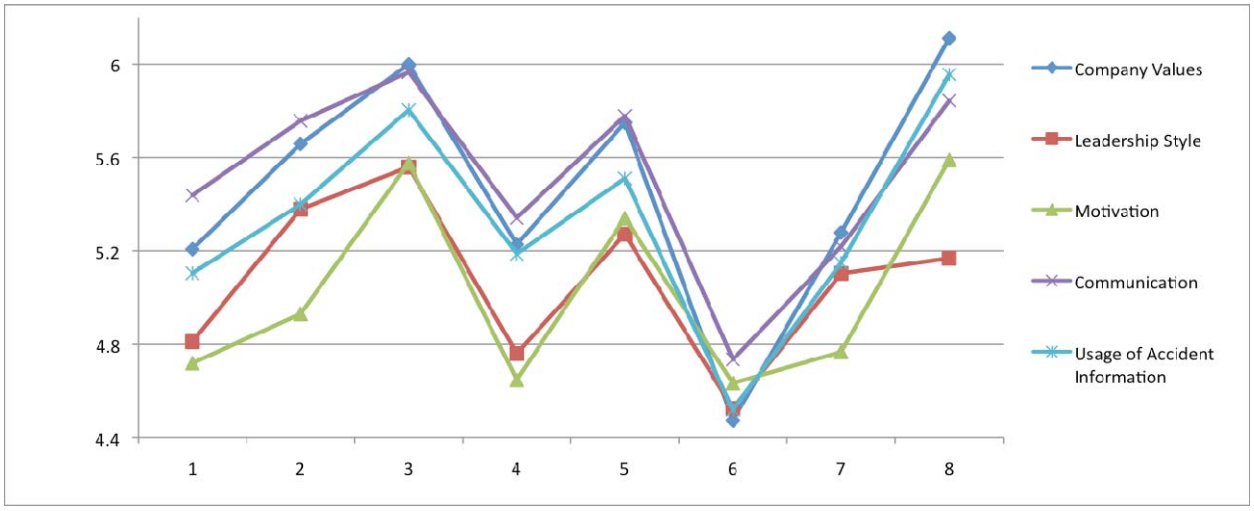

Figure 8. Mean safety culture values and practices scores are presented by plant according to company values, leadership style, motivation, communication, and usage of accident information.

Research Question Two

Are there differences between the plants that achieved and failed to achieve the 2009 safety goals in regard to the average of the summated safety culture values and ractices scores?

Research question two was subdivided into three questions. To answer the three research questions, t-tests were conducted to examine differences among the plants' three safety outcomes and the plants' averages for each of the five summated safety culture values and practices scores.

Plants that achieved and failed to achieve the 2009 OSHA recordable rates, LTA, and severity rates did not differ significantly in terms of their safety culture values and practices scores. The Culture Values and Practice scores and the OSHA rates had small effect sizes, whereas all the scores and severity rates had large effect sizes. The scores and LTA rates had small, medium, and large effect sizes.

Senior management expected significantly higher scores in leadership among the plants that met 2009 safety goals than those that did not. Trends were noted across the eight plants and the plant 3, which met the 2009 OSHA and LTA goals had the highest mean in leadership.

As displayed in Figure 9, Plant 3 had the highest mean for leadership style signifying that employees perceive that their immediate supervisors leadership style emphasized "safety goals achievement and safety promotion." The leadership style dimensions were assessed through items on "active communication, helpful and supportive attitude, and direct involvement of the immediate supervisor in the resolution of safety related issues." (Diaz-Cabrera, 2007, p. 10).

Figure 9. The mean scores for leadership style are presented by plant.

One of the unique aspects of the instrument employed in the study was the assessment of company values. Guldenmund's (2007) evaluation of safety culture research from 1980 to 2003 recognized the emphasis on employees' attitudes towards safety, and acknowledged the paucity of research on determining whether organizations value safety. Further, Guldenmund (2007) recognized the inability to capture safety values through self-administered questionnaires thus far. Applying the Competing Values Framework to safety culture research, eight questions were developed and analyzed in attempted to measure company values.

The results of the company values scores are presented below in Figure 9. Plant 6 scored significantly lower than each of the other plants. It was noted that the two plants 3 and 6 that had the highest scores for leadership also had the highest scores for company values.

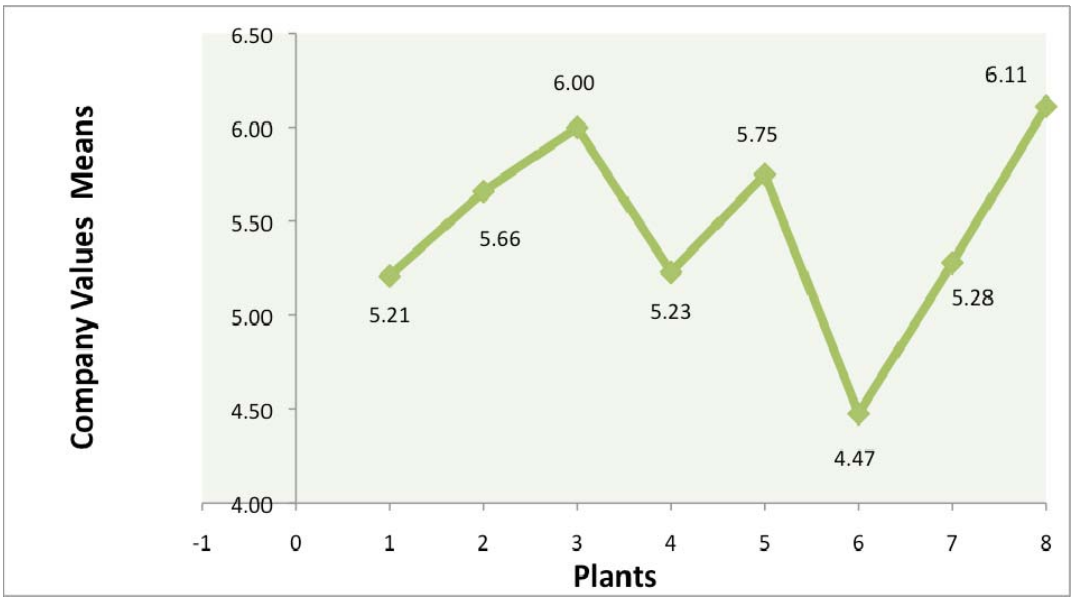

Figure 9. The mean scores for company values are presented by plant.

Research Question Three

Are there differences in the average of the summated safety culture values and practices scores by geographic region?

Research question three was designed to measure differences in the Safety culture values and practices scores between the plants in two geographic regions to study the culture congruency among the plants. To answer this research question, a t-test was conducted to examine the differences among the five summated scores on Safety culture type and geographic location. The five dependent variables were company values, leadership style, motivation, communication, and usage of accident information scores. The independent variables were the

two geographic regions. As noted in Table 16 in the results section, plants in the first geographic region did not differ significantly from the plants in the second geographic region regarding the average of their summated safety culture company values and practices scores.

Research Question Four

How well do the individual and combined safety culture values and practices scores predict 2009 safety performance by plant?

The predictor variables were company values, leadership style, motivation, communication, and usage of accident information. The dependent variables included OSHA, LTA, and severity rates. Research question four was subdivided into three research questions. Multiple regression was conducted using the backward and forward stepwise methods to determine whether the OSHA, LTA, and severity rates could be predicted from the average of the summated Safety culture values and practices scores. The scores did not have significant positive relationship with safety outcomes. The final model actually did not include any variables. Furthermore, the scores from the *Questionnaire of Safety Culture Values and Practices* did not predict 2009 OSHA, LTA, and severity rates in this company.

Research Question Five

Are there differences between the plants that did and did not meet 2009 safety goals in regard to the average of the summated safety culture type?

Sub-questions:

a.) Are there differences between the plants that achieved and did not achieve 2009 safety goals for *OSHA* rates in regard to the average of the summated safety culture type?

b.) Are there differences between the plants that achieved and did not achieve *2009 safety goals* for *LTA* rates in regard to the average of the summated safety culture type?

c.) Are there differences between the plants that achieved and did not achieve 2009 safety goals for *severity* rates in regard to the average of the summated safety culture type?

Statistically non-significant differences existed between plants that achieved and did not achieve 2009 OSHA, LTA, and severity goals in regard to the average of the summated safety culture type. The effect sizes for each of the Safety culture type summated scores and OSHA rates were minimal with the exception of the policy-oriented culture.

Conclusion

This was a non-experimental study conducted in a single organization; therefore, the results cannot be generalized to other companies. As an extension of safety climate instruments, the *Questionnaire of Safety Culture Values and Practices* was intended to assess the core dimensions of safety culture at the individual, department and plant levels. Examining safety from a culture perspective presents more of a holistic perspective of the safety management system than from only a climate perspective. It does so to "encourage the participation of organizational members in risk prevention and to influence members' initiatives and behaviors as a group" (Díaz-Cabrera, 2007, p.1202).

The results of the questionnaire were investigated to determine if the classification of safety culture values and practices scores could differentiate safety performance outcomes at the plant level. The safety culture type failed to serve as differentiators in terms of outcomes, but nevertheless provided some insightful information into the "shared views" (Grote & Künzler, 2000, p. 147) and differences about dimensions of safety culture among plants. After all, this questionnaire was intended to reflect employees' judgment of which aspects of the safety culture contribute to the achievement of safety goals (Grote, 2000).

Neither safety culture type scores nor safety culture values and practices scores were predictors of 2009 OSHA, LTA, or severity rates. The descriptive statistics showed that 51% of those that responded to question one indicated they agree or strongly agree that *only* serious incidents and accidents are reported. If not all incidents and accidents are reported, then it is not possible to compare culture dimensions and to predict outcomes. This offers a possible explanation as to why the safety culture values and practices scores were not predictors of safety outcomes. There are additional latent variables which may include employee turnover, training, and financial resources.

Analyses of Effect Sizes

Both p values and effect sizes were carefully considered in interpreting the statistical results in combination with the study design and adherence to statistical assumptions. Significance values were reported for both significant and non-significant relationships, and statistical significance was indicated at the .05 levels. Cohen's *d* was reported as the indicator of practical significance representing "the strength of the relationship" (Gliner & Morgan, 2009). Thompson also asserted that calculated p values are not useful indices of study effects.

Therefore, the results of the t-tests and ANOVAs lacking statistical significance in this study were not discounted.

The *t*-test results indicated large effects on a) company values, b) communication, and c) usage of accident information between the four plants that achieved and failed to achieve either 2009 LTA or severity goals, despite non-significant results. One possible explanation for the large effect sizes in this study due to the 1,291 survey participants within the eight plants. According to Sigfried, "A large sample can detect statistically significant differences for a small effect (Siegfried, 2010, p. 27). Therefore, it is not known whether the large effect sizes are meaningful. Thompson (1998) outlined variables to consider in weighing statistical versus practical significance. One factor was the reliability of the constructs. The reliability of the constructs in this study was high and Cronbach's alpha ranged from .839 to .940. As Thompson (2007) recommended, the study design should be taken into account when investigating effect sizes. Since this study was limited to 8 plants in a single organization, further research is needed to test the effect sizes among other organizations in multiple industries.

This study did not suggest that a "strong culture is associated with fewer accidents or less severe accidents" as the study by Silva et al., (2004) revealed. Silva et al. studied the relationship among organizational climate and safety climate to develop validated measures of both constructs based on the Competing Values Framework (Cameron & Quinn, 2006). In addition, they examined differences among the newly established safety climate dimensions and low and high accident and severity rates in 1999. Strong correlations existed between safety practices such as, "safety as an organizational value and learning from accidents" and the corresponding accident frequency and severity rates. Furthermore, the effect sizes, ranging from .36 to .92, suggested the "capacity to predict and distinguish organizations with different accident levels,"

(p.217) which was the purpose of this study. The effect sizes in this study for company values and usage of accident information were .212 and minimal for OSHA rates, but were .871 and .969 respectively for LTA. The effect sizes were even larger for severity as 1.182 and 1.286.

The following recommendations were offered to address issues that surfaced from Silva's (2004) survey results: a) testing these survey items in a larger sample to determine the predictive nature of the safety climate factors, and b) analyzing "the specific relationship between climate and culture" p. (218). Silva et al. recommended incorporating items of safety culture in combination with safety climate to predict safety outcomes. The instrument in this study incorporated safety climate items adapted from the instrument of Silva et al. in addition to validated measures of safety culture. However, employee perceptions of items related to safety practices were not predictive of either accident or severity rates in this study.

Although this study was not limited exclusively to climate factors, dimensions such as motivation and leadership style from this study are reflective of climate. The lack of statistical significance between leadership style and safety data did not directly coincide with Clarke's (2006) meta-analysis of 35 studies on positive safety climate and positive safety performance. Neither did it support other studies have shown that a positive safety climate contributes to lower accident rates (Zohar & Luria, 2005). Both motivation and communication had small effect sizes and had non-significant relationships with 2009 OSHA and LTA. Nevertheless, motivation, communication, and severity rates had large effect sizes. Motivation and severity had an effect size of 2.041.

Limitations and Recommendations for Future Research

This study was exploratory and as such, the next step should involve an examination of the instrument's factor structure through a confirmatory factor analysis. The findings from this study suggest the importance of investigating differences in accident rates among plants in this undisclosed company. The primary strength of this study was that the performance outcomes were based on objective data. The limitations of the study included: a.) a small *n* of eight plants and b.) lack of control over work shifts, employee tenure, training, and incentives. The researcher recognized that employees may not report all incidents. Further research is needed to explore the relationship between the safety culture dimensions in this study that were related to accident rates in other studies (Fernandez-Muniz et al., 2007; Grote, 2008; Grote & Künzler, 2000; Silva et al., 2004; Varonen & Markku, 2002; Vredenburgh, 2002). More specifically, all five of the safety culture dimensions and severity rates had large effect sizes with both leadership style and communication exceeding one.

An inherent limitation of survey research is the inability to probe for more information based on the responses. Certainly, it is easier to observe behaviors than to measure values and beliefs. Further research should include qualitative data based on structured interviews and focus groups. For instance, the communication questions asked about the types of communication and frequency of communication, but did not evaluate the quality of communication. It is not known whether the supervisors discussing safety are purely giving lip service or whether their practices are consistent with the conversations they have with hourly employees.

Recommendations for Practice

Clearly, there were latent variables that could not be explained in this study. As Diaz-Cabrera et al. (2007) speculated the instrument might not capture safety culture in its entirety given the many aspects of safety culture. Additionally, it is difficult to measure culture dimensions, such as organizational values exclusively through a questionnaire. According to Grote (2000), there is an issue of "determining shared as well as conflicting norms within and between groups in an organization and the relationship between norms and safe performance" (p.135).

Plant 6 was an anomaly as it was significantly lower on company values from each of the other seven plants, but it met the 2009 safety goals for OSHA and severity. Plant 6 should be examined closely to determine why it was the only plant that scored lower on each of the five dimensions. Additional data should be analyzed and compared with the other 7 plants. For example, annual audit scores might be compared across plants to pinpoint specific practices that could be improved based on observation and survey scores. Continued emphasis should be place on reporting all accidents from minor first aids and up given that only half of the 1,291 respondents believe all accidents are reported.

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Appendix A

OSHA Recordable Incident Rate Calculation

==========

CALCULATIONS

OSHA Recordable Incident Rate

The OSHA Recordable Incident Rate (or Incident Rate) is calculated by multiplying the number of recordable cases by 200,000, and then dividing that number by the number of labor hours at the company.

$$IR = \frac{\text{Number of OSHA Recordable Cases X } 200{,}000}{\text{Number of Employee labor hours worked}}$$

Rate Calculation Example - a company has 17 full-time employees and 3 part-time employees that each work 20 hours per week. This equates to 28,400 labor hours each year. If the company experienced 2 recordable injuries, then the formula works like this:

$$IR = \frac{2 \times 200{,}000}{28{,}400} \qquad IR = \frac{400{,}000}{28{,}400} \qquad IR = 14.08$$

What is now known is that for every 100 employees, 14.08 employees have been involved in a recordable injury or illness. Please note that smaller companies that experience recordable incidents will most likely have high incident rates, or the incident rates will fluctuate significantly from year to year. This is because of the small number of employees (and hence the lower number of labor hours worked) at the company. Calculations are more meaningful at larger companies that have a higher labor hour count.

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Appendix B

Lost Time Case Calculation

Lost Time Case Rate (LTC)

The Lost Time Case Rate is a similar calculation, only it uses the number of cases that contained lost work days. The calculation is made by multiplying the number of incidents that were lost time cases by 200,000 and then dividing that by the employee labor hours at the company.

$$\text{LTC Rate} = \frac{\text{Number of Lost Time Cases} \times 200{,}000}{\text{Number of Employee Labor Hours Worked}}$$

Rate Calculation Example--assume that one of two recordable cases had lost work days associated with the incident. The calculations would look like this:

$$\text{LTC Rate} = \frac{1 \times 200{,}000}{28{,}400} \qquad \text{LTC Rate} = \frac{200{,}000}{28{,}400} \qquad \text{LTC Rate} = 7.04$$

What is now known is that for every 100 employees, 7.04 employees have suffered lost time because of a work related injury or illness.

Appendix C

Severity Rate Calculation

Severity Rate **(SR)**

The severity rate is a calculation that gives a company an average of the number of lost days per recordable incident. Please note, that very few companies use the severity rate as a calculation, as it only provides an average. The calculation is made by dividing the total number of lost workdays by the total number of recordable incidents.

$$SR = \frac{\text{Total number lost workdays}}{\text{Total number of recordable incidents}}$$

Rate Calculation Example – assume there were 5 lost workdays and two recordable incidents. The severity rate calculation would look like this:

$$SR = \frac{5}{2} \quad SR = 2.5$$

What is now known is that for every recordable incident at the company, an average of 2.5 days will be lost due to those work related injuries and illnesses.

Appendix D

Literature Review Method

Initially, I began a broad search using the following keywords ("safety culture*" OR "safety climate*" OR "safety behavior*" OR "safety attitude*" OR "safety intervention*)" string in Digital Dissertations and in the Engineering Compendex database, limited to the United States, published in English, 1999-2009. The 343 results were then limited to manufacturing. A search within the Safety Sciences and Risk database from 1994-2009 using the following keywords yielded 34 results: a.) Organizational culture and safety and manufacturing, b.) Safety culture or safety climate and construction, c.) Organizational culture and outcomes, * and d.) Organizational culture and accidents and manufacturing industry.* Articles on audits and a culture of safety and changing the culture of safety management were incorporated into the review. Non-peer reviewed journal articles were eliminated.

A search of the Health and Safety Science Abstracts database with the keywords "safety culture" yielded 197 results and a search in the Business Source Premier database yielded 415 results on "safety culture." Additional keywords were added to limit results as follows: "safety culture and safety performance indicators," which yield three results in Business Source Premier and nine result in the Engineering Compendex. Further, I located 29 meta analyses using the terms "meta analysis and safety culture" in Science Direct. A search in Digital Dissertations on "safety and days away restricted transfer" rates yielded three dissertations. Two journal articles were located using the terms "injury prediction" and "safety culture" in Science Direct.

Seventeen articles were located related to safety management in Business Source Premier using the search terms "safety management and values." An Ebsco Source Premier search of

multiple databases including Academic Search Premier; Business Source Premier; EconLit; Newspaper Source; PsycINFO; Business Source Elite yielded 41 results. Three articles were incorporated into the study from Safety Science journal issue 34.

Appendix E

Literature Review Search Strings

Variable/Keyword	Specify how the search was conducted i.e. title, subject terms, author & Other search criteria, peer reviewed journals, PDF	# of hits	Database	Categorized as "yes" or "maybe"
	An search of multiple databases including: Academic Search Premier;Business Source Premier;EconLit;Newspaper Source;PsycINFO;Business Source Elite	41	Ebsco Source Premier	1.) 12
Variable: organizational culture & safety outcomes Keywords: 1.) organizational culture and safety and manufacturing 2.) safety culture and U.S. manufacturing 3.) organizational culture and outcomes* 4.) organizational culture and accidents and manufacturing industry*	all publication types; Subject terms; 1994-2009	1.) 7 peer reviewed journal articles; 7 books 2.) 8 peer reviewed journal articles 3.) 5 peer reviewed journals: 5 conferences; 1 book 4.) 1 peer reviewed journal	1.) Safety Sciences and Risk 2.) Safety Sciences and Risk 3.) Safety Sciences and Risk 4.) Safety Sciences and Risk	1.)3 2.)3 3.)0 4.) 1
Variable: organizational culture **Keywords:** 1.) Safety culture	1994-2009	1.) 133 peer reviewed journals; 19 conferences; 7 books	1.) Health and Safety Science Abstracts	1.) 44
Combination of Variables: **Keywords:** 1.) "safety culture*" OR "safety climate*" OR "safety behavior*" OR "safety behavior*" OR "safety attitude*" OR "safety intervention*" 2.) "safety culture*" OR "safety climate*" OR "safety behavior*" OR "safety behavior*" OR "safety attitude*"	1.) 1999-2009 2.) United States, published in English, 1999-2009; journal article	1.)187 results 2.) 343 results	1.) Digital Dissertations and Theses 2.) Compendex Engineering Index	1.)13 2.)41

Variable: Safety Interventions and outcomes **Keywords:** behavior based safety, safety management system, and socio-technical systems and safety 1.) behavior based safety and manufacturing 2.) accidents and socio technical systems 3.) safety interventions and workers compensation claims	all publication types; Subject terms; 1994-2009	1.) 1 peer reviewed journal article; 1 book 2.) 6 peer reviewed journals 3.) 3 peer reviewed journals	1.) Safety Sciences and Risk 2.) Health and Safety Sciences 3.) Health and Safety Sciences	1.) 2 2.) 0 3.) 2
Variable: Safety Interventions (types of) **Keywords:** occupational safety and intervention and manufacturing 1.) occupational safety and intervention and manufacturing 2.) behavior based safety and United States and manufacturing 3.) socio technical system* and manufacturing* 4.) occupational health or occupational exposure or occupational safety or intervention	Boolean phrase; Peer reviewed journal; search within the full text of the articles; within Subject terms; 1994-2009	1.) 10 peer reviewed journal articles 2.) 3 peer reviewed journal articles 3.) 32 peer reviewed journal articles 4.) 43 peer reviewed journal articles	1.) Ebscohost and Business Source Premier 2.) Ebscohost, Business Source Premier, and Psychinfo 3.) Ebscohost, Business Source Premier, Psychinfo, Econlit, and Academic Search Premier 4.) Ebscohost, Business Source Premier, Psychinfo, Econlit, and Academic Search Premier	1. 3 2. 0 3. 2 4. 7
Variable: Safety Interventions **Keywords:** 1.) occupational health or occupational exposure or occupational safety or intervention or "plywood" or "paper industry"	1999-2009; English only	1.) 105 peer reviewed journal articles; 16 conferences; 2 books	Health and Safety Science Abstracts	1.) 3
Variable: DART rates **Keywords:** 1. Days Away Restricted Transfer		1. 3 dissertations	Digital Dissertations and Theses	
		1.		
Variable: Injury prediction and safety culture 1. Injury prediction and safety culture 2. "Injury prediction" and "safety culture"		1.) 4,275 articles 2.) 2	Science Direct	1.)7 2.) 2
Variable: Safety Leadership			Science Direct	
Variable: safety culture and safety outcomes		1.) 9	Engineering Compendex	1.) 2
Meta-analysis and safety culture		1.) 29	Science Direct	
Zohar 2002 safety climate		1.) 1	Business Source Premier	1.) 1

Appendix E

Colorado State University
Knowledge to Go Places

Research Integrity & Compliance Review Office
Office of the Vice President for Research
321 General Services Building - Campus Delivery 2011
Fort Collins, CO
TEL: (970) 491-1553
FAX: (970) 491-2293

NOTICE OF APPROVAL FOR HUMAN RESEARCH

DATE:	January 29,2010
TO:	Waite, Alina, Ph.D., 1588 School of Education DeVoe, Dale, Ph.D., 1501 Dean Applied Hum Sci, Chenhall, Evie, Ph.D. student, School of Education, Gloeckner, Gene, Ph.D., 1588 School of Education
FROM:	Barker, Janell, CSU IRB 2
PROTOCOL TITLE:	Assessing Safety Culture, Values, Practices and Outcomes
FUNDING SOURCE:	NONE
PROTOCOL NUMBER:	09-1484H
APPROVAL PERIOD:	Approval Date: January 29,2010 Expiration Date: January 18,2011

The CSU Institutional Review Board (IRB) for the protection of human subjects has reviewed the protocol entitled: Assessing Safety Culture, Values, Practices and Outcomes. The project has been approved for the procedures and subjects described in the protocol. This protocol must be reviewed for renewal on a yearly basis for as long as the research remains active. Should the protocol not be renewed before expiration, all activities must cease until the protocol has been re-reviewed.

If approval did not accompany a proposal when it was submitted to a sponsor, it is the PI's responsibility to provide the sponsor with the approval notice.

This approval is issued under Colorado State University's Federal Wide Assurance 00000647 with the Office for Human Research Protections (OHRP). If you have any questions regarding your obligations under CSU's Assurance, please do not hesitate to contact us.

Please direct any questions about the IRB's actions on this project to:

Janell Barker, Senior IRB Coordinator - (970) 491-1655 Janell.Barker@Research.Colostate.edu
Evelyn Swiss, IRB Coordinator - (970) 491-1381 Evelyn.Swiss@Research.Colostate.edu

Janell Barker

Barker, Janell

Includes:
Amendment approved to increase the potential sample from 1400 to 2200 participants (i.e., approved to add 800

Appendix F

Alteration of Consent: Dissertation Instrument Cover Letter

Colorado State University

School of Education & College of Applied Human Sciences

Questionnaire of Safety culture values and practices

Dear Participant,

I am a researcher at Colorado State University in the College of Applied Human Sciences. I am conducting a research project as part of my doctoral dissertation on safety culture at [redacted]. The Principal Investigator (PI) for this project is my advisor, Alina Waite, Ph.D., School of Education, and the Co-PI is Gene Gloeckner, Ph.D., School of Education. The title of our project is "Assessing Safety Culture, Values, Practices, and Outcomes."

We are asking you to participate in our research project by taking the Questionnaire of Safety Culture and Values. In the following pages, there are some questions about different aspects of safety at [redacted] grouped by topics. Please indicate on the scale of 1 to 7 whether you agree or disagree with each question related to your company. There are no right or wrong answers. Your participation in this research is voluntary. Your confidentiality will be maintained throughout the research project and individual responses will not be released to the company. At the end of the survey, some information about your job is requested and optional. If you decide to participate in the questionnaire, you may withdraw your consent and stop participation at any time with no consequences.

Our intent is to gain more knowledge on values and practices related to safety culture at [redacted]. All data will be analyzed and scored then summarized for your organization in a final report. Please do not write your name on the survey. Your participation will be confidential to ensure the researchers and your employer will not be able to connect your name to your perceptions. A designated proctor will administer the questionnaire and then collect the questionnaires in an envelope, which will be sealed to maintain total anonymity. Completed surveys will be sent to Colorado State for analysis. When we write about the study to share it with other researchers, neither you nor your company will be identified in these written materials. It is not possible to identify all potential risks in research procedures, but we have taken reasonable safeguards to minimize any known and potential, but unknown, risks.

If you have any questions, please contact Evie Chenhall at 970-492-9240 or 706-207-6323. If you have any questions about your rights as a volunteer in this research, contact Janell Barker, Human Research Administrator, Colorado State University, at 970-491-1655.

Thank you so much for your participation.

Sincerely,

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Appendix G

Questionnaire of Safety Culture Values and Practices

INCIDENT AND ACCIDENT REPORTING SYSTEM
1=Strongly Disagree 7=Strongly Agree

1. My co-workers and I report only serious incidents and accidents, not the less serious incidents and accidents.
2. My co-workers and I report incidents and accidents, even if it interferes with achieving work goals.
3. My co-workers and I participate in the development of new work procedures.
4. I feel that this company values employee compliance with safety policies and procedures.
5. I feel that this company values the honesty of all employees in collecting information about incidents and accidents.
6. I feel that this company values all employees' ability to work together to identify solutions to problems in my work area.
7. I feel that this company values all employees' initiative in identifying new solutions to improve safety.
8. I feel that, at this company, the results of incident and accident investigation are used to develop changes in work procedures based on employee solutions to improve safety.
9. I feel that, at this company, the results of incident investigations are used to revise work goals.
10. I feel that, at this company, the results of incident investigations are used to provide information to employees about the consequences of breaking safety policies and procedures.
11. I feel that, at this company, the results of incident and accident investigations are used to identify training needs and training program development.

SAFETY STANDARDARD POLICIES AND PROCEDURES 1=Strongly Disagree 7=Strongly Agree

12. I feel that, at this company, safety policies are flexible and will be changed, as necessary, to make work practices safer for employees.
13. I feel that, at this company, working conditions will be changed when employees make suggestions to improve safety (when possible).
14. I feel that, at this company, standard operating procedures and safety policies determine how I perform my job.
15. I feel that, at this company, standard operating procedures and safety policies are general guidelines because productivity goals have priority over health & safety goals.

SAFE BEHAVIOR PROMOTION 1=Strongly Disagree 7=Strongly Agree

16. I feel that this company values the contributions of employees who promote health & safety.
17. I feel that this company values employees that follow safety policies and procedures to promote safety.
18. I feel that this company values new and creative suggestions from employees to improve safety.
19. I feel that this company values employees' achievement of both productivity and safety goals.

COMMUNICATION 1=Strongly Disagree 7=Strongly Agree

20. At this company, the managers and employees communicate regularly about issues related to safe working conditions.
21. At this company, managers usually communicate the safety goals to employees.
22. At this company, there is usually formal communication of safety policies and procedures that employees are to follow.
23. This company, there is usually communication among employees to identify solutions to improve safety.

LEADERSHIP SAFE BEHAVIOR
1=Strongly Disagree 7=Strongly Agree

24. My immediate supervisor shows me the safe way to perform my job duties when I act in an unsafe manner.
25. When I perform my job in an unsafe manner, my immediate supervisor analyzes the unsafe behavior to determine the cause.
26. When I perform my job in an unsafe manner, my immediate supervisor corrects me and reminds me about possible penalties.
27. When I act in an unsafe manner, my immediate supervisor discusses with me the most appropriate solution to prevent the unsafe behavior in the future.

JOB SATISFACTION
1=Strongly Disagree 7=Strongly Agree

28. My department encourages teamwork and cooperation between employees and managers.
29. My department cares about employees' job satisfaction.
30. My department provides clear performance expectations through explaining policies and procedures.
31. My department provides well-defined goals that are specific, achievable, and realistic.
32. My work goals are specific, achievable, and realistic.
33. I have variety in my job duties.
34. I am satisfied with the cooperation between employees and managers in my work group.
35. I am satisfied with my performance expectations, including policies and procedures.

Appendix H

Demographic Questions

COMPANY/JOB INFORMATION (Note: The Company does not have access to individual responses)

1. Please indicate your site on your scantron form.

2. Please indicate the one that best describes your level of responsibility on your scantron sheet.

(1) [redacted] Division 1 hourly employee

(2) [redacted] Division 1 supervisor

(3) [redacted] Division 2 hourly employee

(4) [redacted] Division 2 supervisor

(5) [redacted] Division 3 hourly employee

(6) [redacted] Division 3 supervisor

(7) [redacted] Division 4 hourly employee

(8) [redacted] Division 4 supervisor

(9) Other

DEMOGRAPHIC INFORMATION (Optional)

3. Service with the company:

(1) Less than 1 year

(2) 1 to 2 years

(3) 3 to 5 years

(4) 6 to 10 years

(5) 11 to 15 years

(6) 16 to 20 years

(7) 21 years or more

4. Time in current position:

(1) Less than 1 year

(2) 1 to 2 years

(3) 3 to 5 years

(4) 6 to 10 years

(5) 11 to 15 years

(6) 16 to 20 years

(7) 21 years or more

5. How many hours do you typically work in a normal shift?

8 hrs____ 10 hrs____ 12 hrs____ Other_____

6. Which shift do you typically work?

Day_____ Night_____ Rotating shift_____

Appendix I

EFA Comparison Table

ORIGINAL, VALIDATED INSTRUMENT				*MODIFIED DISSERTATION INSTRUMENT*			
	Factor Loadings	Cronbach's Alpha	Item-Total Correlation		Factor Loadings	Cronbach's Alpha	Corrected Item-Total Correlation
Factor 1: Company Values (34.51%)		0.91		**Factor 1: Company Values (20.021%)**		0.940	
(Q5) Values rules fulfillment	0.70		0.72	(Q4) Values employee compliance with safety policies and procedures	0.743		0.766
(Q6) Values sincerity and participation	0.68		0.73	(Q5) Values honesty of all employees in collecting info about incidents and accidents	0.779		0.785
(Q7) Values collaboration in goals achievement	0.59		0.74	(Q6) Values collaboration in goals achievement	0.751		0.795
(Q8) Values the initiative in finding new solutions to improve safety	0.40		0.70	(Q7) Values initiative in indentifying new solutions to improve safety	0.732		0.790
(Q17)Values participation in safety promotion	0.52		0.65	(Q16)Values participation in safety promotion	0.543		0.772
(Q18) Values rules observation to promote safety	0.48		0.64	(Q17) Values employees that follow safety policies and procedures to promote safety	0.518		0.792

ORIGINAL, VALIDATED INSTRUMENT				*MODIFIED DISSERTATION INSTRUMENT*			
	Factor Loadings	Cronbach's Alpha	Item-Total Correlation		Factor Loadings	Cronbach's Alpha	Corrected Item-Total Correlation
(Q19) Values the contribution of creative ideas to improve safety	0.48		0.73	(Q18) Values the contribution of creative ideas to improve safety	0.539		0.813
(Q20) Values goals achievement	0.63		0.71	(Q19) Values goals achievement	0.496		0.779
Factor 2: Leadership Styles (7.71%)		0.91		**Factor 2: Leadership Styles (16.233%)**		0.934	
(Q29)Encourages creativity, faces up to challenges	0.67		0.72	Eliminated Encourages creativity, faces up to challenges due to complex nature of question with multiple constructs			
(Q30) Defines, plans, coordinates aims; motivates subordinates to achieve aims; acknowledges achievement	0.76		0.77	Eliminated Defines, plans, coordinates aims; motivates subordinates to achieve aims; acknowledges achievement due to complex nature of question with multiple constructs			
(Q31) Organizes, coordinates, and controls	0.83		0.79	Eliminated organizes, coordinates, and controls due to complex nature of question with multiple constructs			
(Q32) Promotes cohesion, listens, communicates, and helps	0.74		0.76	Eliminated promotes cohesions, listens, communicates, and helps due to complex nature of question with multiple constructs			

ORIGINAL, VALIDATED INSTRUMENT				*MODIFIED DISSERTATION INSTRUMENT*			
	Factor Loadings	Cronbach's Alpha	Item-Total Correlation		Factor Loadings	Cronbach's Alpha	Corrected Item-Total Correlation
(Q33) Shows the safe way to do the task	0.75		0.74	(Q24) Shows the safe way to perform my job duties	0.764		0.793
(Q34) Analyzes the root cause of the unsafe behavior	0.62		0.67	(Q25) Analyzes unsafe behavior to determine the cause	0.831		0.880
(Q35) Eliminated Warns about possible penalties when I perform my job in an unsafe manner				(Q26) Warns about possible penalties when I perform my job in an unsafe manner	0.833		0.853
(Q36) Offers solutions for unsafe behavior	0.72			(Q27) Discusses most appropriate solution to prevent unsafe behavior	0.809		0.853
Factor 3: Motivation Patterns (4.99%)		0.92		**Factor 3: Motivation Patterns (15.221%)**		0.911	
(Q37) Department cares about satisfaction with the work team, for example: cooperation between employees and managers	-0.93		0.82	(Q28) Department encourages teamwork and cooperation between employees and managers	0.671		0.770
(Q38) Department cares about employees' job satisfaction	-0.92		0.83	(Q29) Department cares about employees' job satisfaction	0.787		0.824

ORIGINAL, VALIDATED INSTRUMENT				*MODIFIED DISSERTATION INSTRUMENT*			
	Factor Loadings	Cronbach's Alpha	Item-Total Correlation		Factor Loadings	Cronbach's Alpha	Corrected Item-Total Correlation
(Q39) Department cares about satisfaction with performance criteria, for example: clarity of policies and procedures	-0.88		0.84	(Q30) Department provides clear performance expectations through explaining policies and procedures	0.707		0.810
(Q40) Department cares about satisfaction with work goals, for example: goals are well-defined	-0.79		0.78	(Q31) Department provides well-defined goals	0.763		0.800
Factor 4: Training Programs (4.46%)		0.86		Training Program Factor: Eliminated due to complex nature of questions and multiple constructs			
(Q45) Human Resources training courses such as: leadership and working in groups; quality of work life; interpersonal communication				Eliminated Human Resources training due to complex nature of questions with multiple constructs			
(Q46) Innovation/change training such as: creativity; group problem-solving; management and development				Eliminated Innovation/change training due to complex nature of question with multiple constructs			
(Q47) Technical and professional training such as: use of tools and equipment; safety rules; norms and procedures				Eliminated Technical and professional training due to complex nature of question with multiple constructs			

ORIGINAL, VALIDATED INSTRUMENT				*MODIFIED DISSERTATION INSTRUMENT*			
	Factor Loadings	Cronbach's Alpha	Item-Total Correlation		Factor Loadings	Cronbach's Alpha	Corrected Item-Total Correlation
(Q48) Goal setting and goal achievement training such as: cost-risk optimization; task and procedure planning; time management				Eliminated Goal-achievement training due to complex nature of question with multiple constructs			
Factor Eliminated: (3.86%)				Factor Eliminated			
(Q2) Eliminated Information about accidents from experience in their work context				(Q2) Eliminated Information about accidents from experience in their work context; did not fit well with any factor; construct not clear			
(Q3) Eliminated Information about accidents that interfere with achieving goals				(Q3) Eliminated Information about accidents that interfere with achieving goals; did not fit well with any factor; construct not clear			
Factor 5: Downward Communication (3.47%)		0.80		**Factor 4: Communication (14.329%)**		0.884	
(Q25) Communication among employees and supervisors about safety	0.62		0.65	(Q20) Communication among employees and supervisors about safety	0.666		0.750
(Q26) Communication of safety goals	0.64		0.64	(Q21) Communication of safety goals	0.778		0.690

ORIGINAL, VALIDATED INSTRUMENT				*MODIFIED DISSERTATION INSTRUMENT*			
	Factor Loadings	Cronbach's Alpha	Item-Total Correlation		Factor Loadings	Cronbach's Alpha	Corrected Item-Total Correlation
(Q27) Formal communication of safety policies and procedures	0.68		0.65	(Q22) Formal communication of safety policies and procedures	0.740		0.700
(Q23) Item not listed on author's factor analysis)				(Q23) Usually communication among employees to identify solutions to improve safety	0.692		0.670
(Q15) Safety rules and procedures are obligatory criteria	0.42		0.48	(Q15) Eliminated			
(Q18) Values observation of safety rules and procedures	0.45		0.58	(Q18) Eliminated			
Factor 7: Safety Promotion Eliminated							
(Q23) Safe performance obtains promotion and economic incentives				Eliminated Safe performance obtains promotion and economic incentives Eliminated			
(Q24) Safe performance gains social recognition				Eliminated Safe performance gains social recognition Eliminated			
(Q15) Safety policies and procedures are obligatory criteria				Eliminated Safety policies and procedures are obligatory criteria			

ORIGINAL, VALIDATED INSTRUMENT				*MODIFIED DISSERTATION INSTRUMENT*			
	Factor Loadings	Cronbach's Alpha	Item-Total Correlation		Factor Loadings	Cronbach's Alpha	Corrected Item-Total Correlation
Factor 6: Usage of Accident Information (3.04%)		0.82		**Factor 5: Usage of Accident Information (9.627%)**		0.839	
(Q9) Change development	-0.51		0.63	(Q8) Changes in work procedures based on employee solutions to improve safety	0.447		0.740
(Q10) Revision of work goals	-0.62		0.72	(Q9) Revision of work goals	0.731		0.630
(Q11) Information about non-observance of policies (rules) and sanctions	-0.8		0.58	(Q10) Information about consequences of breaking safety policies and procedures	0.799		0.530
(Q12) Identification of training needs	-0.62		0.66	(Q11) Identification of training needs	0.546		0.700
Factor 9: Safety Promotion II Eliminated (2.70%)				Factor 9: Safety Promotion II Eliminated			
(Q21) A safe worker avoids penalization				Eliminated A safe worker avoids penalization			
(Q22) A safe worker gains autonomy and responsibility				Eliminated A safe worker gains autonomy and responsibility			
(Q23) The immediate supervisor warns about possible sanctions				(Q26)Moved to leadership factor 2: The immediate supervisor warns about possible penalties			