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Effect of management awareness of safety climate concept on organizational safety climate

Christopher Michael Holzner

Louisiana State University and Agricultural and Mechanical College

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EFFECT OF MANAGEMENT AWARENESS OF SAFETY CLIMATE CONCEPT ON
ORGANIZATIONAL SAFETY CLIMATE

A Thesis

Submitted to the Graduate Faculty of the
Louisiana State University and
Agricultural and Mechanical College
in partial fulfillment of the
requirements for the degree of
Master of Science in Engineering Science

in

The Department of Construction Management and Industrial Engineering

by
Christopher M. Holzner
B.S., Southern Illinois University at Carbondale, 2001
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Abstract

Safety research and practice have shifted focus away from accident rates and accident causal information to a more proactive approach that may predict organizational safety trends. This proactive approach involves the concept of an organizational safety culture and the use of surveys to measure organizational safety climate or ‘snapshot’ of the organizational safety culture. Surveys were administered to line workers, supervisors, and managers at a modular home manufacturing company before and after safety climate information was presented to supervisors and managers in an attempt to measure the effect of the supervisors’ and managers’ increased awareness of the factors that define organizational safety climate as well as investigate potential differences between line workers and supervisors/managers perceptions of the organizational safety climate. Two-way, mixed design analysis of variance (ANOVA) found no significant differences in the survey responses within each group (line workers, supervisors/managers) between two surveys, and between the groups in each survey. Additionally, the survey responses were divided into groups based on the nine safety climate factors that the questions measured and the same analysis was conducted, with no significant differences found. While the safety climate information presentation led to no significant changes in the overall perceived safety climate of the company, the time factor in the study was a limitation and the potential for the application of similar methods in additional studies exists.

Introduction

Recent efforts in both the research and practice of organizational safety have shifted focus away from the traditional approach of analyzing accident rates and accident causal information to attempting to apply a proactive approach that studies the perceptions of workers in a way that may predict organizational safety trends. This proactive approach typically includes an assessment of the organizational safety situation known as the organizational safety climate. This study examines the safety climate of an organization through surveys.

Zohar (1980) first developed the concept of safety climate as a “particular type of organizational climate,” (p. 96) where climate was defined as “a summary of molar perceptions that employees share about their work.” (p. 96). In the thirty years since Zohar introduced the concept of safety climate, researchers have developed various techniques to obtain quantitative representations of organizational safety climate. As safety climate measurement techniques have evolved and been applied, the results correlate positively to the safety performance of the organization they are describing (Mohamed 2002; Carder and Ragan 2003; Cooper and Phillips 2004). These findings suggest that entities ranging from small companies to entire industries have an additional tool offering an opportunity to improve safety performance.

The subject organization of this study is a modular home manufacturing company that performs construction tasks very similar to what is found in on-site home construction, but in a factory setting, classifying it in the North American Industry Classification System (NAICS) under manufacturing, specifically as a Prefabricated Wood Building Manufacturer (NAICS Code 321992). As a reference point, fatal occupational injuries in the construction industry in 2008 accounted for 19% of all fatal occupational injuries reported by the US Department of Labor, while accounting for only 5.6% of the annual average employment reported by the US Department of Labor (USDOL-BS 2009a; USDOL-BS 2009c). In 2008, the Prefabricated

Wood Building Manufacturing industry experienced a rate of 10.3 recordable cases of nonfatal occupational injury and illness per 100 full time workers, more than twice the rate of 4.7 recordable cases per 100 full time workers that the construction industry experienced, nearly three times the Residential Building Construction industry rate of 3.5 recordable cases per 100 full time workers, and was among the very worst of all industries (USDOL-BS 2009a). The subject organization is essentially a residential construction company subject to many of the same operational risks as a residential construction company, but operating in a much more controlled environment, leading one to question why injury and illness rates in its industry are so high.

The US Department of Labor Bureau of Statistics also offers occupational injury and illness information classified by business size, offering additional industry safety details involving the subject organization (USDOL-BS 2009b). The subject organization is classified as a small business by the U.S. Small Business Administration (USSBA 2008), employing approximately 100 personnel, less than a quarter of the personnel required for its designation as a small businesses in its industry (<500 employees) (USSBA 2008). In the U.S., small businesses represent 99.7% of all employer firms, employ more than half of all private sector employees, and pay 44% of the total U.S. payroll (USSBA 2009). Despite such a large presence overall, small businesses, particularly construction companies, and especially ones with short histories, may not have the benefit of overarching organizational safety policies established and fine tuned through years of existence and tested by hundreds of man-years of labor. The 2008 incidence rates of total recordable cases of nonfatal occupational injuries and illnesses in the Prefabricated Wood Building Manufacturing industry involving businesses with 50-249 employees was higher than the average, with 12 injuries or illnesses per 100 full time employees compared to the average of 10.3 for the same NAICS code (all company sizes included), and more than three

times the rate of 3.5, the average for residential construction (USDOL-BS 2009b). Figure 1 provides side by side comparisons of the aforementioned injury and illness rates. The subject organization's characterization as a small business is important to this study because typical efforts to study safety management trends have been conducted on large companies with dedicated safety staffs or consultation teams, assets that may not be financially practical in small businesses. Additionally, the management and supervisory staff of small construction-related businesses may be composed of craftsmen with years of experience but minimal formal safety training.

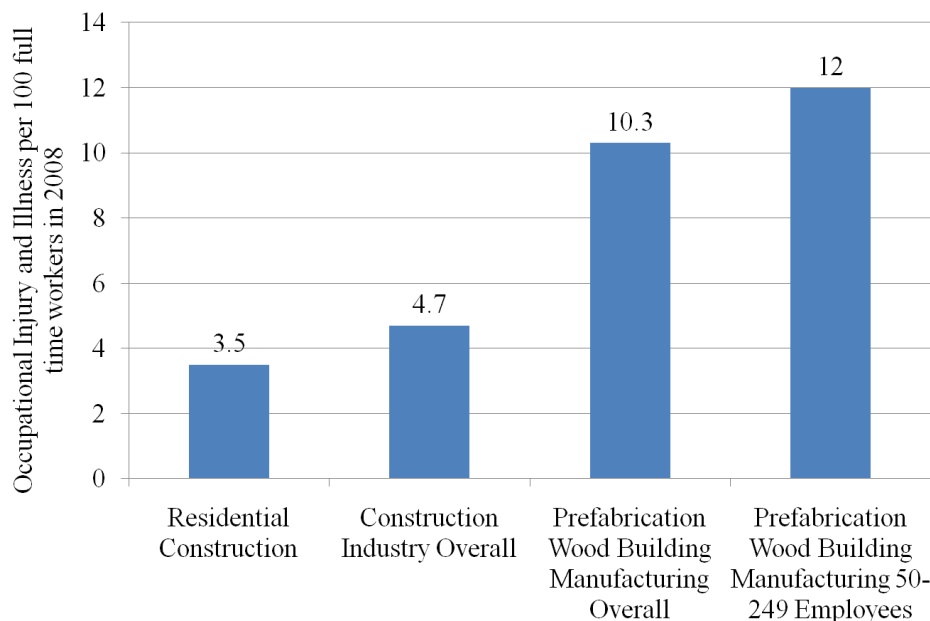


Figure 1: Comparison of occupational injury and illness rates of construction and prefabricated wood building manufacturing

An observation of the subject organization operations led to an anecdotal conclusion that the organizational safety culture was poor. Safety performance data for the industry and company size associated with the subject organization is consistent with a poor organizational safety culture, as well. Past research on safety climate has clearly established correlation between an organization's safety climate and safety performance, but very limited information

was found on how organizations used safety climate information to implement changes, only that action was taken and subsequent surveys indicated an improvement in safety climate (Carder and Ragan 2003). No study or reference was discovered in the literature review that specifically addressed safety climate in small businesses, contributing more significance to the subject organization's small business status in this study. The current study attempted to address these gaps in knowledge with the following objectives: evaluate safety climate in a construction-related small business; study the effect of introducing the concept of safety climate to a construction-related small business that has been observed as lacking a positive safety culture; and compare the safety climate indicated by employees to the safety climate indicated by supervisors and management. This thesis will provide information on the state of safety climate in a construction-related small business. It is asserted that the nature of small business and the career path of the management of the organization have produced a lack of exposure to the concepts of safety culture and safety climate, resulting in the lack of a positive safety culture. If an increased understanding of the significant influence that company management has on company safety climate can be shown to positively affect the company's safety climate, it may lead to the development of relatively simple but effective training that can be instituted in small businesses with little cost.

Literature Review

Construction and Manufacturing Safety

It is often asserted that construction is inherently dangerous and therefore accidents are going to occur regardless of measures taken to prevent them. Accidents in construction are not unique in that they can be attributed to causes such as recklessness, apathy, error in judgment, or lack of knowledge, training, supervision, or means to carry out tasks safely (Sawacha *et al.* 1999). The nature of the construction industry, however, does create a relatively unique combination of challenges to safety such as a transient workforce, constantly shifting worksite configurations and conditions, and exposure to weather (Sawacha *et al.* 1999). The subject organization of this study is able to eliminate many of these challenges that are major contributors to risk in traditional construction because it operates a manufacturing line that, while constructing modules of homes using mostly conventional construction techniques and materials, operates in an environment that is very predictable and sheltered from weather.

Safety Climate

Zohar (1980) first established and discussed the concept of safety climate as one of several specific climates that, together, make up an organizational climate. Zohar's work became the basis for thirty years of relatively sparse safety climate research. Zohar (1980) analyzed and compiled factors from multiple sources that, when applied together, created a snapshot of companies with successful safety programs. The factors outlined by Zohar(1980) were related to strong management commitment to safety and were indicated by:

1. Esteemed status or rank of company safety officers
2. Commitment to timely and appropriate safety training
3. Open communication between workers and management concerning safety
4. General environmental control and good housekeeping
5. A stable workforce with low turnover and seasoned workers.

The exact definition of climate as used in the term safety climate varies from paper to paper, researcher to researcher, but Wiegmann *et al.* (2004) identified the following commonalities:

1. Safety climate is a psychological phenomenon that is usually defined as the perceptions of the state of safety at a particular time.
2. Safety climate is closely concerned with intangible issues such as situational and environmental factors.
3. Safety climate is a temporal phenomenon, a ‘snapshot’ of safety culture, relatively unstable and subject to change. (p. 124)

Safety Climate and Safety Culture

The reference to safety culture by Wiegmann *et al.* (2004) offers a segue into another area of study sometimes mistakenly discussed interchangeably with safety climate. The term ‘safety culture’ became widely used following the 1986 Chernobyl Nuclear Power plant accident where two explosions became “the worst accident in the history of commercial nuclear power generation.” (p. 119) (Wiegmann *et al.* 2004). Denison (1996) wrote extensively about differences between organizational culture and organizational climate. Among nearly all the encountered literature, it was accepted, either explicitly or implicitly that safety climate and safety culture were part of the larger organizational climate and organizational culture of the company, respectively. Denison (1996) went into great detail about how organizational culture studies published in the late 1980’s and early 1990’s began to look like organizational climate studies that were conducted twenty or more years earlier, and asserted that the two concepts were becoming nearly unrecognizable from each other. Such has not been the case in the study of safety climate and safety culture since the turn of the century, with the two being discussed with clear differences, but related, in the same studies, something not often seen in organizational climate and organizational culture studies discussed by Denison. A very recent study was published that clearly delineates how each exists separately (Teo and Feng 2009), using critical features to describe safety culture and quoting Wiegmann *et al.* (2004):

1. Safety culture is a concept defined at the group level or higher that refers to the shared values among all of the group or organization members.
2. Safety culture is concerned with formal safety issues in an organization and closely related to, but not restricted to, the management and supervisory systems.
3. Safety culture emphasizes the contribution from everyone at every level of an organization.
4. The safety culture of an organization has an impact on its members' behavior at work.
5. Safety culture is usually reflected in the contingency between reward systems and safety performance.
6. Safety culture is reflected in an organization's willingness to develop and learn from errors, incidents, and accidents. (p. 123)

Teo and Feng (2009) concluded that safety climate and safety culture were related in that the safety culture of an organization can be indicated by the safety climate of the organization, with the safety climate measured by the administration of questionnaires.

Safety Climate in Construction

Teo and Feng (2009) and Mohamed (2002) examined safety climate in construction settings while Abudayyeh *et al.* (2006) investigated management's commitment to safety in construction, a readily accepted significant factor in the safety climate concept. While Teo and Feng (2009), Mohamed (2002), and Abudayyeh *et al.* (2006) focused on the construction industry, their findings were very similar to safety climate studies focused on other industries (Zohar 1980; Coyle *et al.* 1995; Neal *et al.* 2000; Carder and Ragan 2003; Cooper and Phillips 2004).

Teo and Feng (2009) studied the relationship between safety climate and safety culture in an attempt to establish safety climate as a reliable indicator of safety culture in construction companies. Through the use of a questionnaire developed for the study, Teo and Feng (2009) measured relationships between safety climate and the psychological aspect, behavioral aspect, and situational/environmental aspect of safety culture. Through empirical examination, Teo and Feng (2009) concluded that the safety culture of construction organizations could be reliably

predicted by safety climate assessment. Organizations exhibiting positive safety culture would have lower occupational injury and illness rates (Molenaar *et al.* 2002).

Mohamed (2002) studied the safety climate factors of management commitment, communication, rules and procedures, supportive and supervisory environments, workers' involvement, personal appreciation of risk, appraisal of work environment, work pressure, and competence, applied to construction. Mohamed (2002) developed a survey based on several other researchers' work, administering it to 68 carpenters, steel fixers, equipment operators and electricians from 10 different companies. Concluded was that a positive association existed between safety climate and safe work behavior and that a positive safety climate existed when management demonstrated a commitment and non-punitive approach to safety and promoted open communication concerning safety related issues (Mohamed 2002). Also concluded was that work pressure did not show a significant relationship with safety climate (Mohamed 2002).

Abudayyeh *et al.* (2006) also developed and administered a survey to construction companies, but the survey was designed to obtain information at the company level, meaning that one survey was completed per company. Abudayyeh *et al.* (2006) reached conclusions very similar to Mohamed (2002), stating findings that showed a clear negative correlation between management commitment to safety and occupational injury and illness rates.

Approaches to Assessing Safety Climate

Various approaches have been taken to develop systems to measure safety climate, very often using questionnaires or surveys. Questionnaires or surveys were designed to obtain employees' perceptions on multiple dimensions associated with safety in an organization. Among the approaches were questionnaires that asked questions related to organizational safety with responses indicated on a Likert Scale (Zohar 1980; Coyle *et al.* 1995; Clarke 1999; Mohamed 2002; Molenaar *et al.* 2002; Cooper and Phillips 2004; Abudayyeh *et al.* 2006; Teo

and Feng 2009). While each study established validity and reliability figures for each respective method, surveys were used that were either unique or were detached enough from the survey on which they were based, that reliability and validity relationships could not be made.

Present Study Approach to Assessing Safety Climate

The survey method selected for this study is based on the survey developed by Carder and Ragan (2003), which was based on the Minnesota Perception Survey, and does not use a Likert Scale, but simple “yes” or “no” answers to survey questions. This survey was selected because its methodology produced consistent and valid results and was applied over more applications and with a larger sample group than any other survey encountered.

Carder and Ragan (2003) worked with Bailey (1997) to modify the Minnesota Perception Survey, an employee perception survey seeing its first use in the railroad industry in the late 1970’s. The resulting survey was administered to more than 6000 employees at more than 50 chemical plant sites. Initial validation studies were conducted on 12 sites, six selected for exhibiting low accident rates and judged by safety professionals as demonstrating good safety programs, and six selected for exhibiting higher accident rates and judged by safety professionals as demonstrating safety programs that were lacking (Carder and Ragan 2003). Each question of the original survey had a desirable and an undesirable answer (Carder and Ragan 2003). Excellent survey sites would have a higher proportion of desirable answers if the questions were valid (Carder and Ragan 2003). Some of the questions were determined to be invalid by using a Yates-corrected chi-square statistic, and were discarded (Carder and Ragan 2003). Through iterations of the Carder and Ragan (2003) administered surveys, questions were added to obtain information specific to chemical companies, and were validated using the same method. Reliability of the survey was established using both the split-half technique and by plotting time phased survey results from the same plants (Carder and Ragan 2003). The split-half technique

rendered reliability coefficients in the range of 0.9 (Carder and Ragan 2003). Plotting survey results from the same plants in different years resulted in the need to look for correlation between changes in survey results and changes in accident rates, yielding a Pearson coefficient of -0.87 (Carder and Ragan 2003). These statistics indicate that the survey has acceptable reliability.

Carder and Ragan (2003) used focus groups to develop factors measured by their survey.

Carder and Ragan (2003) established that their survey measured a total of nine factors:

1. Management Demonstration
2. Education and Knowledge
3. Supervisory Process
4. Employee Involvement
5. Fitness for Duty
6. Emergency Preparedness
7. Off the Job Safety
8. Process Safety
9. Environmental Protection

Of the 96 questions used by Carder and Ragan (2003), this study will use 82 (Appendix A). The 14 questions removed from the survey for this study were associated with emergency preparedness in a chemical plant environment, and were specific enough that they clearly would not apply to this study's subject organization. Two questions associated with general emergency preparedness were retained and included in this study. Of the 82 total questions, 79 are questions whose favorable answer is 'yes', allowing for a simple, first pass review to identify completed surveys where respondents simply circled 'yes' or 'no' for all questions because they were disinterested in offering honest answers.

Additionally, two sources of data were reviewed and found to bolster this survey-based process as a tool for safety performance improvement. First, surveys were taken before and after a safety performance improvement initiative was put in place. The initiative targeted "management's visibility in supporting safety" (p. 162) (Carder and Ragan 2003). The analysis

of the pre- and post-initiative surveys showed a statistically significant improvement in the areas addressed by the initiative and the company experienced a “long lasting reduction in the recordable accident rate in excess of 50%” (p. 162) (Carder and Ragan 2003). Finally, 22 plant managers with three years of survey use were surveyed for their opinions of the process effectiveness. Most of the respondents viewed the survey favorably (Carder and Ragan 2003).

Pre- and Post-action Approach

The approach of using a survey to measure the factors commonly associated with the safety climate of an organization before and after actions are taken to improve the safety performance of the company was applied by Carder and Ragan (2003). Carder and Ragan (2003) administered a limited version of their survey and concluded that the perception of management’s commitment to safety was weak. The company took specific action to address the issue, and eight months later a follow-up survey indicated that the areas specifically targeted for improvement saw a statistically significant improvement (Carder and Ragan 2003). It is the investigator’s assertion that the subject organization’s observed weak safety culture is due, in large part, to lack of management commitment. It is assumed that the supervisors and management of the subject organization *want* a safe organization. The presentation of the safety climate concept will focus on research findings concerning management commitment and its positive impact on safety culture and organizational safety performance.

Literature Review Summary

The proactive approach to safety management began with Zohar (1980) outlining the safety climate concept with factors that were strongly seated in management’s commitment to safety. Safety climate was eventually described as a ‘snapshot’ (p. 124) or measure of safety culture (Weigmann *et al.* 2004) and indicated by survey. Organizations with a positive safety

culture had lower occupational injury and illness rates (Molenaar *et al.* 2002). An existing survey that measures the factors of safety climate illustrated in Figure 1, with an extensive application history and thoroughly examined for validity and reliability was chosen for the present study (Carder and Ragan 2003). Carder and Ragan (2003) found that statistically significant changes were indicated by their survey, administered before and after specific actions were taken to address shortcomings associated with safety climate.



Figure 2: Safety climate factors

Method

The objective of this study was to investigate safety climate change through the use of surveys. The study examined safety climate survey results for differences in safety climate perceptions between workers and supervisors/managers and between surveys administered at different times. Surveys indicating employees' perceptions of organizational safety management were administered to the employees of the organization before, and several weeks after, basic conceptual safety climate information was presented to the leadership of the company. The survey data was analyzed to identify changes in all company personnel perceptions of organizational safety management associated with additional management awareness of safety climate concepts.

Hypotheses

Hypothesis 1

H₀: Company supervisory and management personnel do not perceive the organizational safety climate differently from the line workers executing the work.

H₁: Company supervisory and management personnel perceive the organizational safety climate differently from the line workers executing the work.

Hypothesis 2

H₀: A basic awareness or increase in awareness of the organizational safety climate concept by supervisory and management personnel will have no effect on the overall organizational safety climate in approximately one month.

H₁: A basic awareness or increase in awareness of the organizational safety climate concept by supervisory and management personnel will affect the overall organizational safety climate in approximately one month.

Setting

The study setting was a modular home manufacturing facility in the southern United States. The facility combines the tasks typical to on-site residential construction with the standardization and repeated tasks of an assembly line. The facility utilizes an assembly line concept with 19 sequential stations, producing approximately 15 homes per month.

Participants

All participants were employees of the same modular home manufacturing facility in the southern United States. The first survey was completed by 43 participants, while the second survey was completed by 30 participants. Basic demographic information was collected from each participant as part of the survey (Appendix A): gender, age, education level, experience in industry, time with company, and status as craftsman (line worker), supervisor, or manager. Designation of participants as supervisors was at the discretion of the subject organization's management, but in general, a supervisor oversaw at least 4 other line workers at a particular workstation. The plant production manager, plant assistant production manager, tool manager, and inventory manager were the participants classified as managers. Considering participants that completed either the first or second survey, there were 46 unique participants, 42 males and 4 females. The mean (standard deviation) age of participants that responded to the age question was 40.5 (10.5) years, while the mean construction experience of participants that responded to the construction experience question was 13.7 (10.3) years.

Survey Instrument

The survey used (Appendix A) was based on a survey developed by Carder and Ragan (2003). It uses 82 yes or no questions, 79 with yes as the favorable response and 3 with no as the favorable response. This combination allowed for easy identification of surveys that were

completed by respondents not interested in offering honest feedback by responding yes to all of the questions, responding no to all of the questions, or responding in an inconsistent manner. The survey was scored based on the percentage of responses that were favorable, disregarding questions without responses. The survey applied nine factors contributing to the safety climate as a measure of overall safety climate: Management Demonstration (questions 1-20); Education and Knowledge (questions 21-31); Supervisory Process (questions 32-37); Employee Involvement (questions 38-46); Fitness for Duty (questions 47-48); Emergency Preparedness (questions 49-50); Off the Job Safety (questions 51-52); Process Safety (questions 53-66); and Environmental Protection (questions 67-82). The participants took 15-25 minutes to respond to the survey.

This survey was selected because it was the survey most examined for reliability and validity as well as the most extensively applied survey encountered in the review of safety climate literature (see Literature Review).

Safety Climate Concept Presentation

An informational brief on the organizational safety climate concept was presented by the investigator to the supervisors and management of the subject organization. The subject organization requested that supervisors/managers be broken into two groups for the presentation of the safety climate concept informational brief, allowing half of the group to remain on the plant floor, minimizing the operational impact of having supervisors/managers away from their posts. The brief was presented to the first half of the supervisors/managers one week after the administration of the first survey while the brief was presented to the second half of the supervisors/managers two weeks after the administration of the second survey. The investigator assembled basic conceptual organizational safety climate information from published journal articles and presented a PowerPoint based brief (Appendix B). The most commonly accepted

definition of organizational safety climate, as well as characteristics typically associated with organizations identified as having positive and negative safety climates were presented. The briefs lasted approximately one hour and took place on the subject organization premises. Copies of all sources used in preparing the presentation were made available to the company for review. Supervisors were designated as such by the subject organization and were included in the informational presentation at the discretion of management.

As a side note, the safety climate concept information presentation discussed eight factors contributing to safety climate, while nine were actually measured in the survey. An error by the investigator resulted in the emergency preparedness factor being left off the safety climate concept information presentation.

Experimental Design

Independent Variables

The independent variables were: 1) Time. A within subjects variable, the two variable designations of time are *before* and *after* the organizational safety climate concept information was presented to the supervisors and management. 2) Company Position/Status. A between subjects variable, the two variable designations of company position/status are *line worker* and *supervisor/management*.

Dependent Variables

The primary dependent variable was the safety climate survey results, measured as the percentage of total favorable responses. A set of secondary dependent variables were the survey results classified by the nine safety climate factors (described in Survey Instrument), measured in the same manner as the overall results, as the percentage of favorable responses to questions associated with each safety climate factor.

Experimental Procedure

The survey and awareness process of the experiment is illustrated in Figure 3 and outlined in the following:

1. The two groups of the study, workers and supervisors/managers, received an informed consent brief and signed informed consent forms (Appendix D) for the administration of all steps associated with the study.
2. The survey (Appendix A) was administered to both groups.
3. Supervisors/managers received an informed consent brief and signed informed consent forms (Appendix D) for the administration of the safety climate concept information presentation.
4. Approximately half of the supervisors/managers received a presentation on the safety climate concept one week after the survey was administered. The remaining supervisors/managers received a presentation on the safety climate concept two weeks after the survey was administered.
5. Four weeks after the survey was first administered, the survey was re-administered to both groups.

Hypothesis Analysis

Results were first examined using descriptive statistics (means and standard deviations). Both hypotheses were analyzed by two-way mixed-factors analysis of variance (ANOVA) ($\alpha=0.05$). Two-way ANOVA allowed analysis of both hypotheses while indicating interaction between the independent variables (time and company position/status). Results from the survey administered prior to the safety climate concept information presentation were compared to the survey administered two/three weeks after the presentation. Results from both surveys were examined for differences between the line worker and supervisor/management groups. Results

were analyzed in terms of the whole survey and by each of the nine factors composing the survey.

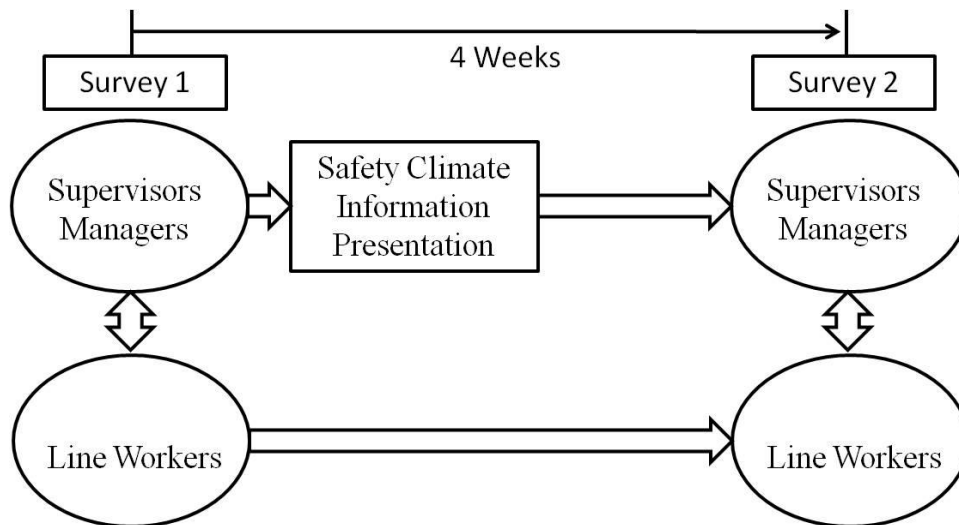


Figure 3: Experimental Process Model

Results

Descriptive Statistics

The first survey session yielded 43 completed surveys and the second survey session yielded 30 completed surveys. Two surveys were disregarded from each survey session based on inconsistent responses of either all yes replies or impossible replies to employment or experience questions, leaving 41 surveys and 28 surveys used for the analysis from survey sessions one and two, respectively. The survey results are shown in Figure 4. Overall, the means of favorable response percentages were lower from the first survey than from the second, but the difference was not statistically significant. Figure 5 shows the survey results broken down by group, line workers and supervisors/managers. In both surveys, supervisors/managers favorable response percentage means were lower than line workers, but with a larger standard deviation. The differences between groups in both surveys were not statistically significant. Figure 6 compares group favorable response percentage means between survey 1 and survey 2, with both group favorable response percentage means increasing between survey 1 and 2. The increase however, was not statistically significant.

The favorable response percentage for each individual question in the survey, as well as manager/supervisor favorable response percentages to each individual question was calculated and the results are contained in Appendix C.

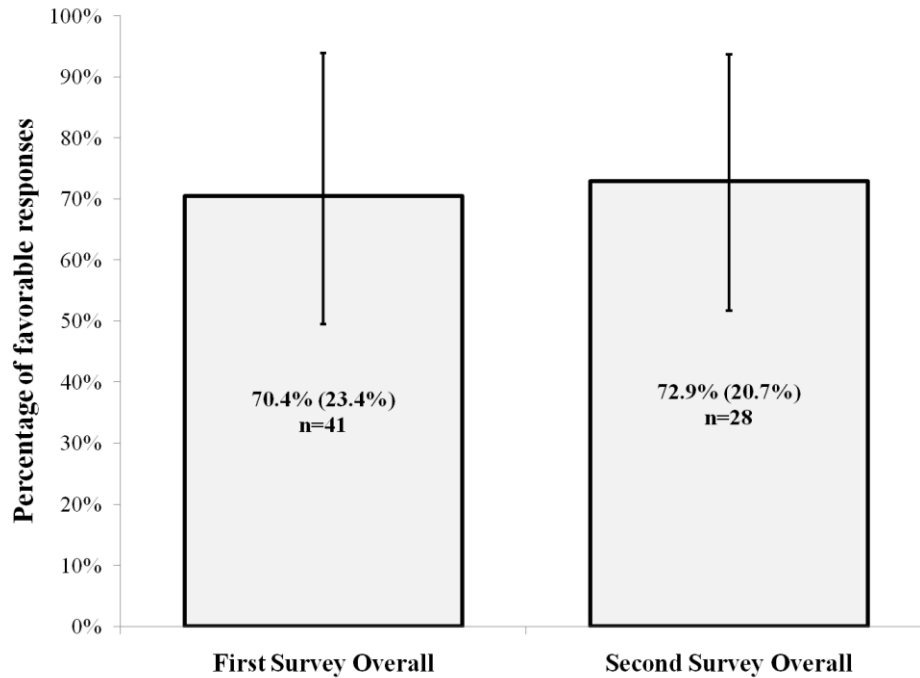


Figure 4: Overall favorable response percentage means (standard deviation) with sample sizes for first and second surveys

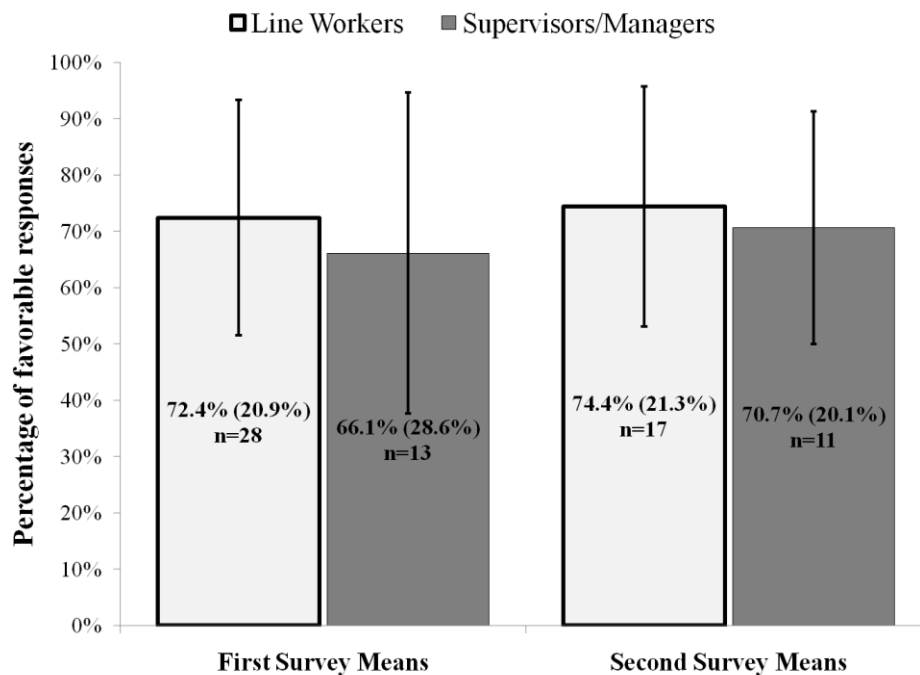


Figure 5: Survey position specific percentage of favorable response means (standard deviation) with sample sizes by survey and side by side comparison of line workers and supervisors/managers

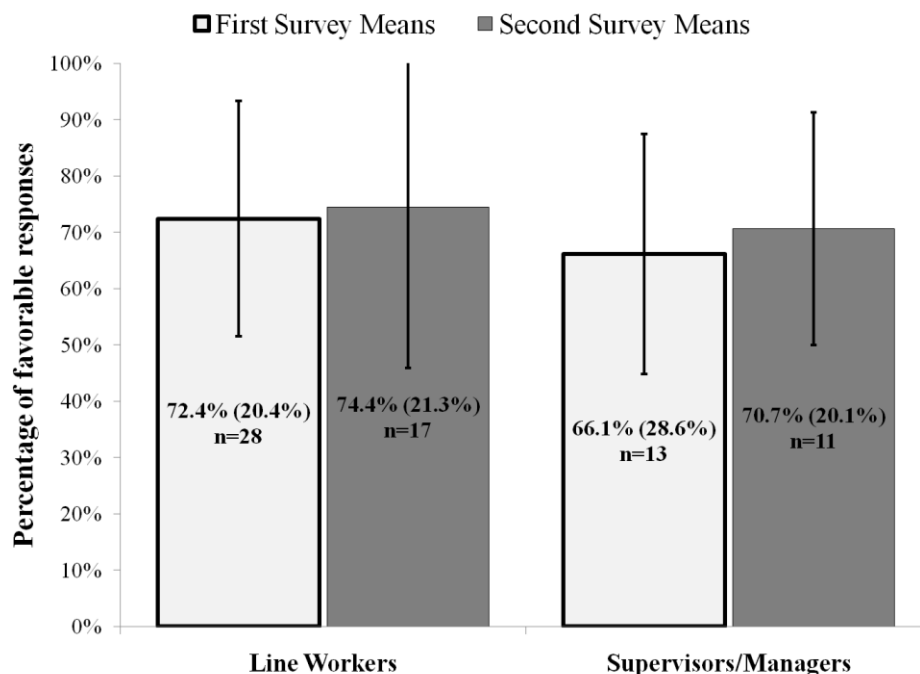


Figure 6: Survey position specific percentage of favorable response means (standard deviation) with sample sizes by group and side by side comparison of first and second surveys

Factor Specific Descriptive Statistics

Analysis was conducted by breaking the survey into sections by safety climate factors measured by question groups as described in the Survey Instrument portion of the Method section and the results are shown in Table 1. There were considerable differences between line workers and supervisors/managers in the favorable response percentage means of several factors but there were also large standard deviations. From survey 1, differences between line workers and supervisors/managers in the management demonstration and employee involvement factors were 11.3 percentage points and 8.7 percentage points respectively. From survey 2, the difference between line workers and managers/supervisors for the off the job safety factor was 38.6 percentage points, but the results for both the line workers and managers/supervisors were extremely variable. No statistically significant difference was found, however. More specific information is included in the ANOVA results.

Table 1: Factor specific descriptive statistics

factor	Survey 1		Survey 2	
	line workers	supervisors/managers	line workers	supervisors/managers
management demonstration	84.8% (17.6%)	73.5% (29.4%)	84.9% (18.4%)	78.5% (21.6%)
education and knowledge	80.5% (23.3%)	76.9% (30.5%)	80.2% (24.7%)	76.9% (22.8%)
supervisory process	68.5% (33.7%)	66.4% (33.9%)	70.4% (31.4%)	72.7% (34.4%)
employee involvement	83.2% (20.0%)	74.5% (28.2%)	87.5% (20.0%)	84.8% (20.0%)
fitness for duty	75.9% (37.6%)	80.8% (38.4%)	71.9% (36.4%)	63.6% (45.2%)
emergency preparedness	46.4% (48.9%)	46.2% (51.9)	58.8% (47.6%)	59.1% (49.1%)
off the job safety	50.0% (45.1%)	42.3% (51.9%)	75.0% (40.8%)	36.4% (45.2%)
process safety	71.8% (27.7%)	71.4% (33.0%)	72.8% (27.7%)	74.0% (27.1%)
environmental protection	67.0% (28.8%)	61.1% (34.0%)	65.2% (31.8%)	64.2% (32.6%)

ANOVA Results

Using SAS software, ANOVA found no significant difference between the line worker and supervisor/manager (group) responses between surveys ($p=0.6870$), nor did it find any significant difference within group responses between the first and second survey (survey) (interaction of group*survey, $p=0.2232$). No significant difference was found between the overall results of the first and second surveys (time) ($p=0.4363$). The accompanying ANOVA table is shown in Table 2.

Table 2: ANOVA table for all survey results analyzed

Effect	Numerator DF	Denominator DF	F Value	Pr > F
group	1	44	0.16	0.6870
survey	1	21	0.63	0.4363
survey*group	1	21	1.58	0.2232

A post hoc analysis was conducted using least squares means to provide more detailed insight into the specific interactions. The supervisor/manager and line worker interaction result was $p=0.420$ for the first survey and $p=0.970$ for the second survey. The group specific interaction between surveys result was $p=0.714$ for the line workers and $p=0.205$ for the supervisors/managers.

Analysis was also conducted using only the results from participants who completed both surveys, allowing for a true repeated measures analysis. No significant difference was found

between the line workers and supervisors/managers (group) responses within each survey ($p=0.2966$), nor was any significant difference found within group responses between the first and second survey (survey) ($p=0.1871$). No significant difference was found between the overall results of the first and second surveys (time) ($p=0.4871$). The accompanying ANOVA table is shown in Table 3.

Table 3: ANOVA table for only repeat participants

Effect	Numerator DF	Denominator DF	F Value	Pr > F
group	1	21	1.15	0.2966
survey	1	21	0.5	0.4871
survey*group	1	21	1.86	0.1871

Again, a post hoc analysis using least squares means was used to examine specific interactions. The supervisor/manager and line worker interaction result was $p=0.168$ for the first survey and $p=0.546$ for the second survey. The group specific interaction between surveys result was $p=0.605$ for the line workers and $p=0.199$ for the supervisors/managers. As with the overall analysis, these results offer more detailed insight into the data.

The factor specific ANOVA found no significant differences between line workers and supervisors/managers, nor between surveys, in any of the nine safety climate factors with the smallest p-value occurring in the interaction between line workers and supervisors/managers in the off the job safety factor ($p=0.0726$).

Discussion

Study Overview

This study sought to examine two areas related to organizational safety climate: 1. The effect of an increase in the subject organization leadership's awareness of the safety climate concept on organizational safety climate. 2. Possible differences between the subject organization's line workers' perceptions of the organizational safety climate and the supervisors'/managers' perceptions of the organizational safety climate. The investigation was prompted by an anecdotal conclusion by the investigator that the subject organization had a poor safety culture. The conclusion was reached after several observations made during tours of the organization's facility during normal operations. Observed were unsafe acts and conditions that appeared to be a routine part of operations. The risks assumed in the unsafe acts and conditions were clearly associated with factors outlined by Carder and Ragan (2003) and examined in the survey, such as management demonstration (commitment), education and knowledge, and employee involvement. While Carder and Ragan (2003) did not associate qualitative levels with survey scores, survey response means of nearly 30% unfavorable may indicate that the employees of the subject organization perceive significant shortcomings in the company's safety program. Both null hypotheses asserted the absence of differences between survey response means, examined by group and by survey, and neither was rejected.

Hypothesis 1

There was insufficient evidence to conclude that company supervisory and management personnel perceive the organizational safety climate differently from the line workers, although management personnel had slightly lower scores than line workers. Based on the means from both groups and both surveys, however, the organization appears to agree that the safety program of the organization contains unfavorable elements.

Hypothesis 2

There was insufficient evidence to conclude that a basic awareness or increase in awareness of the organizational safety climate concept by the supervisory and management personnel resulted in a significant effect on the organizational safety climate in two to three weeks, although scores increased slightly in the follow-up survey. There were three expected outcomes involving a change in the overall safety climate perception: 1. The first survey would prompt the participants to more closely observe their safety program in action and respond to the second survey with more scrutiny of their safety culture; 2. The first survey would prompt the participants to increase their effort in enforcing safety, resulting in more confidence in their safety program and safety culture being reflected in the second survey; 3. The safety climate concept information presentations to the supervisors/managers would prompt additional action on improving the safety program and both the line workers and supervisors/managers would respond more positively on the second survey.

The most noteworthy element of the conclusion lies in the very short time involved between the safety climate concept information presentation and the second survey. Research by Carder and Ragan (2003) found improvement in the safety performance, by the decrease of the recordable accident incident rate of a company studied, following a safety improvement program instituted based on the results of their survey. In the Carder and Ragan (2003) study, improvement was first noted approximately three months after the program was instituted, supporting the assertion that the current study's two to three week dwell time following the safety climate concept information presentation to the supervisors/managers may not have been long enough to see significant results if the presentation did have any effect on the organizational safety climate. Additional discussion of this element is addressed in the limitations section.

Safety Climate Concept Information Presentation

The safety climate concept information presentation used in this study is in Appendix B. It was created by the investigator for the specific purpose of its presentation to the supervisors and managers of the subject organization between the first and second surveys administered for this study. The safety climate concept information presentation content was taken from Zohar (1980), Mohamed (2002), O'Toole (2002), Carder and Ragan (2003), Wiegmann *et al.* (2004), Abudayyeh *et al.* (2006), and Choudry *et al.* (2007). All of these articles discussed safety culture and/or safety climate with common or complimentary information. During the two sessions the presentation was delivered to the supervisors and managers of the subject organization, its content sparked considerable discussion on the application of its concepts, the challenges involved, and specific examples pertaining to the organization. A copy of the presentation was left with each person attending the presentation. It appeared to the investigator that the attendees of the presentation were able to match concepts discussed in the presentation with issues experienced in their organization, both positive and negative. Several of the attendees made positive comments about the safety climate factors listed in the presentation and asked specific questions about how to apply them to their leadership roles to improve safety. Other attendees suggested that it was impractical to maintain standards that would lead employees to answer every question on the survey favorably, essentially stating that risk was a part of the business and was sometimes necessary for the sake of production efficiency. Overall, the presentation seemed to have a positive impact on the attendees in several ways not measurable by the methods or within the limitations of this study, specifically the time between the presentations and second survey. At least one of the supervisors appeared vindicated by the information, expressing overwhelming agreement with what was being presented. Other supervisors expressed that they had not considered some of the factors outlined in the presentation, illustrating that learning had

taken place. Several supervisors asked questions they appeared to know the answers to, but looked to the investigator to confirm that, as supervisors, sometimes leading safety involves being placed in positions, making decisions, or taking actions that are initially and sometimes permanently unpopular.

Limitations

Time

The time between the safety climate concept information presentation to the supervisors and managers and the administration of the second survey was only two or three weeks. This severely limited the amount of time supervisors and managers were allowed to implement any changes in safety practices deemed appropriate. Even if changes were made by the supervisors and managers immediately, understanding and adoption of the changes by the line workers and establishment of a favorable view of the changes would be unlikely in such a short time. In an example presented by Carder and Ragan (2003) where surveys were administered before and after corrective action was taken and a positive result was measured, the time between surveys was eight months.

Subject Organization Instability

When the study was conceived, the subject organization actively employed approximately 100 line workers and supervisors. When the surveys were administered, however, because of turbulence in company direction and management, coupled with seasonal variations in the production schedule, layoffs resulted in considerably fewer line workers, offering smaller sample sizes overall and making the ratio of supervisors to line workers much larger than anticipated. Additionally, many of the employees who completed the first survey did not complete the second survey and many employees who completed the second survey did not complete the first survey. While little apparent effect on the response means of the groups was

indicated, speculation exists as to what a repeated measures analysis would have rendered if all the participants who completed the first survey also completed the second survey.

Inability to Present to Entire Staff at Once

Due to practical operational requirements, only half of the supervisor and management staff were available at one time to receive the safety climate concept information presentation. This potentially impacted the study in two ways. It reduced the time between when the second group received the presentation and the second survey session. It also did not allow the entire staff to benefit from the discussion cultivated in each individual presentation.

Factors for Continued Research on Safety Climate in Small Businesses

Maintaining a focus on small businesses with continued research in the spirit of this study may render simple, but effective training opportunities for small business owners to include in their organizational safety training and practice. Because management commitment to safety is the most important factor of safety climate, additional work in the area of safety climate concept and its introduction to the owners and management of small companies has the potential to create organizational safety cultures rooted in safety program implementation as a leadership skill, not the forced compliance, nuisance of doing business it is often accused of being in the construction industry (O'Toole 2002). Applying elements of the current study in the following ways may result in methods of improving small business safety practices.

Larger, More Stable Company

A larger, more stable, company with a similar product and facility, while staying within the confines of small business classification would expand this study to an organization offering a larger sample size as well as enabling an experiment that would come closer to a true repeated measures design.

Multiple Companies

Applying this study's methodology to multiple construction companies of varying size, specialty, and history may yield additional insight into the factors of construction safety based on those organizational factors.

Longer Interval, More Surveys, More Information with Larger Target Audience

Allowing a significantly longer interval between surveys, as well as conducting multiple follow-up surveys may allow additional application of information and training to the organization, especially in response to trends resulting from the surveys. Involving the line workers and sub-contractors as well as the supervisors and management of the company may offer additional benefit. This approach would require a stable, very cooperative, and appropriately sized company.

Conclusion

The subject organization responses illustrated that its safety climate has potential for improvement. The safety climate concept informational presentation and time allowed for supervisors/managers to apply its elements to the organization resulted in no significant improvement of the safety climate, as perceived by the employees of the company. The limitations imposed by the instability of the company and the time constraints involved in the study leave ample areas for the expansion of its concepts and methods. As long as occupational accidents and illness exist, the relationship between safety climate and accident and illness rates will maintain significant potential for study.

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Appendix A: Safety Climate Questionnaire

Name: _____

Age: _____

Gender (circle one): Male Female

Education Completed (circle one): (10th grade or less) (11th grade) (GED) (High School) (Some college)
(Associates Degree) (Bachelors Degree) (Masters Degree)

Years of Construction Experience: _____

Time working at XXXX: _____ years, _____ months

What is your job at XXXX? _____

Are you a supervisor? Yes No

Are you considered management? Yes No

1. Does management insist upon proper medical attention for injured employees?	YES	NO
2. Is safe work behavior recognized by supervisors?	YES	NO
3. Do you believe the equipment and facilities you work with are maintained to ensure a safe operation?	YES	NO
4. Do supervisors pay adequate attention to safety matters?	YES	NO
5. Do employees participate in setting goals for safety?	YES	NO
6. Do you think your company seeks fast correction of problems found during safety inspections?	YES	NO
7. Is safe work behavior recognized by your company?	YES	NO
8. Have your company's efforts encouraged you to work more safely?	YES	NO
9. Are tools and equipment maintained in a manner which helps prevent accidents?	YES	NO
10. Do different departments work together to improve the safety of construction/production processes?	YES	NO

11. Are changes to procedures and processes adequately reviewed to ensure safety?	YES	NO
12. Do you feel the construction/production processes you work with are properly designed to operate safely?	YES	NO
13. Does your supervisor ask what you need to make your job safer?	YES	NO
14. Are there barriers that prevent you from having adequate communication with other departments in the company?	YES	NO
15. Our company's safety and health policy is well understood.	YES	NO
16. Our company is doing more about safety and health than most other similar companies.	YES	NO
17. I believe my company wants to be the best it can be in health and safety.	YES	NO
18. Adequate resources are applied to the health and safety effort.	YES	NO
19. Management is as concerned about safety success as it is about business success.	YES	NO
20. Are contractors at your site required to meet your company's health and safety standard?	YES	NO
21. When you are asked to do a new job, do you receive proper training?	YES	NO
22. Is the amount of safety training given to supervisors adequate?	YES	NO
23. Are safety rules regularly reviewed with employees?	YES	NO
24. Do the people in your department understand the relationship between what they do and the company's safety program?	YES	NO
25. Did you receive adequate safety training related to your job?	YES	NO
26. Do employees understand the hazards of the operations they perform?	YES	NO
27. Do supervisors provide a safety orientation for newly assigned employees?	YES	NO

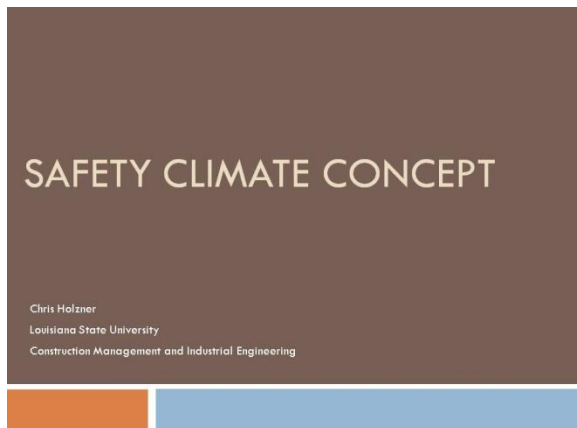
28. Is information that is needed to operate safely made available to employees?	YES	NO
29. We share health and safety information with outside departments.	YES	NO
30. Do employees understand the reasons behind the rules they are asked to follow?	YES	NO
31. Is your training regularly updated?	YES	NO
32. Are minutes of safety meetings kept and follow-up files maintained?	YES	NO
33. Is discipline usually assessed when safety rules are broken?	YES	NO
34. Are checks made to be sure required protective equipment is being used?	YES	NO
35. Do supervisors discuss safety goals and performance with employees regularly?	YES	NO
36. Are employees checked on a routine basis to see whether they are doing their jobs safely?	YES	NO
37. Does the company have a uniform procedure for dealing with employees who violate rules?	YES	NO
38. Do supervisors discuss accidents and injuries with employees involved?	YES	NO
39. Do your coworkers support the company's safety program?	YES	NO
40. Do employees participate in the development of safe work practices?	YES	NO
41. Do employees caution other employees about unsafe practices?	YES	NO
42. Are accidents and injuries thoroughly investigated?	YES	NO
43. Do employees have a regular opportunity to attend safety meetings?	YES	NO
44. Do employees participate in inspections for potential hazards?	YES	NO
45. My coworkers believe that taking personal responsibility for	YES	NO

health and safety is a condition of their employment?		
46. Do employees act to correct hazards they find?	YES	NO
47. Does your company deal effectively with problems caused by alcohol or drug abuse?	YES	NO
48. Are employees who are using alcohol or drugs on the job able to work without detection?	YES	NO
49. Have you been trained on what to do if there is a serious emergency?	YES	NO
50. Have you been properly trained on how to respond to emergencies in your work area?	YES	NO
51. Is off-the-job safety a part of your company's safety program?	YES	NO
52. Is your family more concerned about off-the-job safety as a result of the company's safety program?	YES	NO
53. Every process and production change is fully reviewed for its potential health and safety impact?	YES	NO
54. Does your company actively search for near-miss incidents?	YES	NO
55. Are operating procedures reviewed and revised on a timely basis?	YES	NO
56. Do people listen to your suggestions to process safety improvement and take them seriously?	YES	NO
57. Our company is better than other construction/building manufacturing companies at preventing process accidents.	YES	NO
58. Do employees participate in construction/production process hazard reviews?	YES	NO
59. Do you have confidence in the results of your company's construction/production process?	YES	NO
60. Management is as concerned about construction/production process safety as it is about business success.	YES	NO
61. Do you receive adequate hazard analysis and construction/production process safety information?	YES	NO

62. Do your coworkers have an understanding of the construction/production processes in your plant?	YES	NO
63. Do employees understand the hazards of operating under special conditions not typical to daily operations?	YES	NO
64. Does your company effectively investigate incidents that have a potential for catastrophe?	YES	NO
65. Are changes made to construction/production processes (order of operations, procedure, or personnel involved) without proper review?	YES	NO
66. Are you encouraged to suggest improvements to construction/production process safety at your company?	YES	NO
67. Nothing is more important at my company than protecting people and the environment.	YES	NO
68. Do you feel a responsibility to act if you see a hazard or environmental problem?	YES	NO
69. Do you believe that you personally can prevent and environmental accident?	YES	NO
70. Environmental issues are regularly discussed.	YES	NO
71. Do employees participate in the development of better environmental practices?	YES	NO
72. Are environmental concerns a part of all business decisions?	YES	NO
73. Our company is more committed than other construction/building manufacturing companies to environmental protection.	YES	NO
74. Have you spoken to neighbors or friends about your company's commitment to health and safety excellence?	YES	NO
75. Do employees caution other employees about practices that could lead to environmental problems?	YES	NO
76. Are you adequately trained to respond to an environmental incident?	YES	NO
77. Do you believe management is committed to environmental protection?	YES	NO

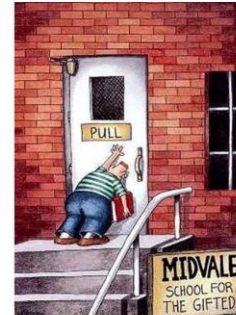
78. Do employees have an adequate understanding of the environmental rules relating to the processes they're involved with?	YES	NO
79. Do supervisors pay adequate attention to environmental issues?	YES	NO
80. Do employees receive recognition for doing a good job with environmental concerns?	YES	NO
81. Do you have a good understanding of the particular vulnerability of the environment surrounding your facility?	YES	NO
82. Management is as concerned about environmental protection as it is about business success.	YES	NO

Appendix B: Safety Climate Concept Information Presentation



Introduction

- Who am I?
- Why am I here?
- Presentation-Discussion
- Significant Assumption
- Ask questions!



Outline

- What's the POINT?
- Safety Management History
- Organizational Culture and Climate
- What is Safety Culture?
- What is Safety Climate?
- Factors of Safety Climate Discussion
- Safety Climate at [REDACTED]

What's the POINT?

- This information is for YOU!
 - Created specifically for the leadership of [REDACTED]
- Information concerning organizational safety research for supervisors and managers
- Information to help you to decide if or where you may be able to make [REDACTED] a safer place to work

Safety Management History

- Injury and Illness Rates
 - Safety Audits
 - Compliance
 - Engineering Controls
-
- Proactive Approach
 - Beyond Compliance
 - Safety Culture

Organizational Culture and Climate

- Organizational Culture Defined: "the way we do things around here."
- Organizational Climate Defined: Perception of organizational culture.

What is Safety Culture?

- Chernobyl-1986-First Mainstream Use of Term 'Safety Culture'
 - ▣ "worst accident in the history of commercial nuclear power generation."
 - ▣ Lack of 'Safety Culture' blamed
- Safety Culture defined
 - ▣ Shared values, beliefs, assumptions, and norms that may govern organizational decision making, as well as individual and group attitudes about safety

More Safety Culture Info

- Emphasizes contributions from everyone at every level
- Impacts safety behavior
- Willingness to learn from incidents and accidents

What is Safety Climate?

- Safety Climate Defined: Perceptions of the state of safety at a particular time; a *snapshot* of the safety culture
- Safety Climate Measured
 - ▣ The survey you (and your workers) took
 - ▣ What is the survey measuring?

Factors of Safety Climate



Management Commitment to Safety

- Overwhelming results indicate that management commitment to safety is most important element of safety program
- Do your actions convey the message that safety at [redacted] is very important?
- Personal Observation
- Survey
 - ▣ Is safe work behavior recognized by supervisors at [redacted] How?
 - ▣ [redacted] safety and health policy is well understood by employees. (yes? or no?) How do you know?

Education and Knowledge

- Survey
 - ▣ Do employees at [redacted] understand the reasons behind the rules they are asked to follow? If not, why not?
 - ▣ Is the amount of safety training given to [redacted] supervisors adequate? Adequate for what? Understanding? Compliance? Leadership?
- What's the safety goal at [redacted]? Compliance? Zero Accidents? [redacted]

Supervisory Process

- Survey
 - ▣ Does [REDACTED] have a uniform policy for dealing with employees who violate (safety) rules?
 - ▣ Do supervisors at [REDACTED] discuss safety goals and performance with employees regularly?

Employee Involvement

- [REDACTED] Employee involvement
 - ▣ Are [REDACTED] employees committed to safety?
 - ▣ Are [REDACTED] employees involved in the safety process?
 - ▣ Do [REDACTED] employees feel empowered to improve safety?
 - Open Communication
 - Constructive Correction of Safety Issues

Off The Job Safety

- Survey
 - ▣ Is off the job safety a part of your company's safety program?
- Off the job safety discussed
 - ▣ What do you wear when you cut your grass?
 - ▣ Accidents at home?

Safety Climate at [REDACTED]

- Why is the safety climate of [REDACTED] important?
 - ▣ Indicator of Safety Culture
 - ▣ Relationship between organizational safety climate and organizational safety performance
 - ▣ Report Card
 - Organizational Safety
 - Management commitment to safety
 - ▣ It's a tool!

Closing Thoughts



"Now! ... That should clear up a few things around here!"

Closing Thoughts

- Do you want a safe workplace?
- The most important part of a safety program is the commitment of organization management and supervisors to the program
- Did the survey make you think about potential for improvement?
- Questions?

More info?

□ Chris Holzner

■ holzner1@earthlink.net

■ 228-669-2065

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Appendix C: Survey Question Specific Favorable Response Percentages

	Survey 1			Survey 2		
	Favorable Response %			Favorable Response %		
Question Number	Supervisors/Managers	Line Workers	Overall	Supervisors/Managers	Line Workers	Overall
1	92.3%	100.0%	97.5%	90.9%	100.0%	96.4%
2	84.6%	92.9%	90.2%	100.0%	94.1%	96.4%
3	69.2%	100.0%	90.2%	72.7%	82.4%	78.6%
4	69.2%	89.3%	82.9%	81.8%	94.1%	89.3%
5	46.2%	85.7%	73.2%	54.5%	76.5%	67.9%
6	84.6%	88.9%	87.5%	81.8%	88.2%	85.7%
7	76.9%	85.2%	82.5%	63.6%	88.2%	78.6%
8	76.9%	85.7%	82.9%	81.8%	88.2%	85.7%
9	76.9%	100.0%	92.7%	90.9%	94.1%	92.9%
10	61.5%	82.1%	75.6%	90.9%	70.6%	78.6%
11	69.2%	85.7%	80.5%	81.8%	88.2%	85.7%
12	76.9%	92.9%	87.8%	72.7%	82.4%	78.6%
13	84.6%	70.4%	75.0%	63.6%	75.0%	70.4%
14	69.2%	53.6%	58.5%	45.5%	62.5%	55.6%
15	92.3%	96.4%	95.1%	90.9%	100.0%	96.4%
16	75.0%	70.4%	71.8%	50.0%	75.0%	65.4%
17	76.9%	89.3%	85.4%	81.8%	94.1%	89.3%
18	61.5%	78.6%	73.2%	90.9%	94.1%	92.9%
19	61.5%	76.9%	71.8%	90.9%	70.6%	78.6%
20	69.2%	72.0%	71.1%	90.9%	81.3%	85.2%
21	66.7%	74.1%	71.8%	45.5%	70.6%	60.7%
22	84.6%	79.2%	81.1%	81.8%	64.7%	71.4%
23	92.3%	88.5%	89.7%	72.7%	88.2%	82.1%
24	84.6%	92.6%	90.0%	81.8%	88.2%	85.7%
25	76.9%	77.8%	77.5%	63.6%	76.5%	71.4%
26	76.9%	96.3%	90.0%	90.9%	94.1%	92.9%
27	61.5%	69.2%	66.7%	72.7%	82.4%	78.6%
28	84.6%	88.9%	87.5%	90.9%	100.0%	96.4%
29	53.8%	61.5%	59.0%	72.7%	76.5%	75.0%
30	84.6%	96.3%	92.5%	100.0%	88.2%	92.9%
31	84.6%	59.3%	67.5%	72.7%	52.9%	60.7%
32	63.6%	62.5%	62.9%	81.8%	87.5%	85.2%
33	61.5%	65.4%	64.1%	72.7%	58.8%	64.3%
34	61.5%	63.0%	62.5%	63.6%	76.5%	71.4%
35	76.9%	66.7%	70.0%	81.8%	58.8%	67.9%
36	69.2%	63.0%	65.0%	72.7%	64.7%	67.9%
37	69.2%	80.8%	76.9%	60.0%	75.0%	69.2%

	Survey 1			Survey 2		
	Favorable Response %			Favorable Response %		
Question Number	Supervisors/Managers	Line Workers	Overall	Supervisors/Managers	Line Workers	Overall
38	69.2%	77.8%	75.0%	90.9%	76.5%	82.1%
39	84.6%	85.7%	85.4%	81.8%	94.1%	89.3%
40	61.5%	78.6%	73.2%	81.8%	88.2%	85.7%
41	69.2%	96.4%	87.8%	81.8%	82.4%	82.1%
42	91.7%	88.0%	89.2%	90.9%	94.1%	92.9%
43	100.0%	96.4%	97.6%	90.9%	100.0%	96.4%
44	53.8%	59.3%	57.5%	63.6%	64.7%	64.3%
45	76.9%	81.5%	80.0%	100.0%	93.3%	96.2%
46	69.2%	82.1%	78.0%	81.8%	94.1%	89.3%
47	84.6%	85.2%	85.0%	72.7%	81.3%	77.8%
48	76.9%	65.2%	69.4%	54.5%	62.5%	59.3%
49	46.2%	46.4%	46.3%	54.5%	52.9%	53.6%
50	46.2%	46.4%	46.3%	63.6%	62.5%	63.0%
51	30.8%	50.0%	43.6%	36.4%	75.0%	59.3%
52	53.8%	46.2%	48.7%	36.4%	73.3%	57.7%
53	61.5%	70.4%	67.5%	81.8%	64.7%	71.4%
54	53.8%	46.2%	48.7%	63.6%	64.7%	64.3%
55	76.9%	61.5%	66.7%	81.8%	73.3%	76.9%
56	84.6%	48.1%	60.0%	81.8%	70.6%	75.0%
57	76.9%	76.9%	76.9%	70.0%	81.3%	76.9%
58	69.2%	66.7%	67.5%	63.6%	75.0%	70.4%
59	76.9%	76.9%	76.9%	81.8%	88.2%	85.7%
60	76.9%	80.8%	79.5%	81.8%	87.5%	85.2%
61	69.2%	66.7%	67.5%	72.7%	76.5%	75.0%
62	76.9%	88.5%	84.6%	81.8%	93.8%	88.9%
63	69.2%	88.5%	82.1%	63.6%	62.5%	63.0%
64	76.9%	85.2%	82.5%	72.7%	64.7%	67.9%
65	46.2%	60.0%	55.3%	50.0%	50.0%	50.0%
66	84.6%	76.9%	79.5%	81.8%	70.6%	75.0%
67	84.6%	88.9%	87.5%	72.7%	81.3%	77.8%
68	92.3%	100.0%	97.5%	81.8%	94.1%	89.3%
69	76.9%	96.2%	89.7%	72.7%	94.1%	85.7%
70	53.8%	44.4%	47.5%	54.5%	52.9%	53.6%
71	53.8%	64.3%	61.0%	54.5%	52.9%	53.6%
72	69.2%	63.0%	65.0%	81.8%	70.6%	75.0%
73	69.2%	66.7%	67.5%	54.5%	58.8%	57.1%
74	30.8%	42.9%	39.0%	54.5%	29.4%	39.3%
75	69.2%	71.4%	70.7%	72.7%	58.8%	64.3%

	Survey 1			Survey 2		
	Favorable Response %			Favorable Response %		
Question Number	Supervisors/Managers	Line Workers	Overall	Supervisors/Managers	Line Workers	Overall
76	53.8%	44.4%	47.5%	54.5%	47.1%	50.0%
77	61.5%	66.7%	65.0%	72.7%	81.3%	77.8%
78	53.8%	66.7%	62.5%	72.7%	64.7%	67.9%
79	46.2%	59.3%	55.0%	54.5%	64.7%	60.7%
80	38.5%	53.6%	48.8%	36.4%	52.9%	46.4%
81	61.5%	70.4%	67.5%	72.7%	76.5%	75.0%
82	61.5%	66.7%	65.0%	63.6%	70.6%	67.9%

Appendix D: Informed Consent Forms

“XXXX Organization Safety Survey”

Performance site: XXXX. Modular home manufacturing facility located at XXXX.

Investigators: Dr. Laura Ikuma, 225-578-5364, likuma@lsu.edu; Christopher Holzner, 228-669-2065, holzner1@earthlink.net

Purpose of the Study: This study examines attitudes and perceptions of the employees of XXXX towards organizational safety.

Subject Inclusion: Employees of XXXX.

Exclusion criteria: Participants who quit or are fired from XXXX during the study will be removed from the study. Pregnant employees of XXXX.

Number of Subjects: 50

Study Procedures: You will first read this consent form. If you agree to participate, you will complete two surveys (82 Yes/No Questions) on the organizational safety at your workplace. One survey will be completed today, the second survey will be completed 30-45 days from today. Each survey will take approximately 30 minutes to complete.

Benefits: There is no direct benefit to individual participants; however, this study may provide future information that is helpful in improving your workplace.

Risks/Discomforts: There are no physical risks involved in the experiment.

Right to Refuse: At any time during the study, you have the right to not participate or withdraw from the study. There will be no adverse action taken for withdrawal.

Privacy: The LSU Institutional Review Board (which oversees university research with human subjects) may inspect and/or copy the study records.

Results of the study may be published, but no names or identifying information will be included in the publication.

Other than as set forth above, subject identity will remain confidential unless disclosure is legally compelled (ordered by a court).

Removal: You are expected to follow the investigators’ instructions. If you fail to follow the investigator’s instructions, you will be removed by an investigator from the experiment.

Signatures: The study has been discussed with me and all my questions have been answered. I may direct additional questions regarding study specifics to the investigators. If I have questions about subjects’ rights or other concern, I can contact Robert C. Mathews, Louisiana State University Institutional Review Board, at (225) 578-8692. I agree to participate in the study described above and acknowledge the investigator’s obligation to provide me with a signed copy of the consent form.

Participant Signature

Date

Participant Printed Name

“XXXX Organizational Safety Climate Concept Informational Presentation”

Performance site: XXXX. Modular home manufacturing facility located at XXXX.

Investigators: Dr. Laura Ikuma, 225-578-5364, likuma@lsu.edu; Christopher Holzner, 228-669-2065, holzner1@earthlink.net

Purpose of the Study: The purpose of this portion of the study is to provide you with work-related information on the concept of Organizational Safety Climate.

Subject Inclusion: Supervisory and Management personnel of XXXX.

Exclusion criteria: Participants who quit or are fired from XXXX during the study will be removed from the study. Pregnant employees of XXXX.

Number of Subjects: 20

Study Procedures: You will first read this consent form and be given a verbal explanation of the study. If you agree to the terms of participation, you will attend a one hour informational presentation discussing the concept of Organizational Safety Climate.

Benefits: The direct benefit to you is the opportunity for professional development in the area of safety; however, this experiment may provide future information that is helpful in improving your workplace.

Risks/Discomforts: There are no physical risks involved in the experiment.

Right to Refuse: At any time during the study, you have the right to not participate or withdraw from the study. There will be no adverse action taken for withdrawal.

Privacy: The LSU Institutional Review Board (which oversees university research with human subjects) may inspect and/or copy the study records.

Results of the study may be published, but no names or identifying information will be included in the publication.

Other than as set forth above, subject identity will remain confidential unless disclosure is legally compelled.

Removal: You are expected to follow the investigators' instructions. If you fail to follow the investigator's instructions, you will be removed by an investigator from the experiment.

Signatures: The study has been discussed with me and all my questions have been answered. I may direct additional questions regarding study specifics to the investigators. If I have questions about subjects' rights or other concern, I can contact Robert C. Mathews, Louisiana State University Institutional Review Board, at (225) 578-8692. I agree to participate in the study described above and acknowledge the investigator's obligation to provide me with a signed copy of the consent form.

Participant Signature

Date

Participant Printed Name

Vita

Christopher Holzner enlisted in the US Army in 1993, serving as an Explosive Ordnance Disposal (EOD) Technician until 1997. He graduated with a Bachelor of Science Degree in Mechanical Engineering from Southern Illinois University at Carbondale in May 2001, attended US Navy Officer Candidate School, Pensacola, Florida, and was commissioned as an Ensign in the Navy Civil Engineer Corps in August 2001. He has served in Key West, Florida; Pearl Harbor, Hawaii; Okinawa, Japan; Afghanistan; and Gulfport, Mississippi. Following completion of requirements for a Master of Engineering Science Degree, he will report for duty as the Public Works Officer at Navy Information Operations Command-Hawaii.