1-1-2011

Proactive Personality and Big Five Traits in Supervisors and Workgroup Members: Effects on Safety Climate and Safety Motivation

Michael Anthony Buck
Portland State University

10.15760/etd.268

Proactive Personality and Big Five Traits in Supervisors and Workgroup Members:

Effects on Safety Climate and Safety Motivation

by

Michael Anthony Buck

A dissertation submitted in partial fulfillment of the
requirements for the degree of

Doctor of Philosophy
in
Applied Psychology

Dissertation Committee:
Donald M. Truxillo, Chair
Leslie B. Hammer
Talya N. Bauer
Katherine E. McDonald
Berrin Ergodan

Portland State University

ABSTRACT

In 2009 there were 3.28 million non-fatal occupational injuries and illnesses (Bureau of Labor Statistics, 2010). Of these injuries and illnesses, 965,000 resulted in lost days from work. In addition there were 4,340 workplace fatalities. Given the number of occupational injuries, illnesses, and fatalities, and the associated direct and indirect costs, organizations have sought to improve safety at work. Safety climate and safety motivation are two variables hypothesized to affect safety behaviors and safety outcomes. Safety climate refers to the shared perceptions of workgroup members, of the organizations' commitment to safety as evidenced by heir immediate supervisors' pattern of implementing safety policies and procedures (Zohar, 2003). Therefore, the workgroup supervisor plays an major role in the development of safety climate. Social exchange theory and previous studies of leadership styles and safety suggest that supervisors who convey concern for subordinates' well-being increase workers' motivation to reciprocate by increasing their safe behaviors at work. However, no research to date has examined the relationship between supervisors' personality and workers perceptions of safety climate, or the effect of Big Five trait-level variables on workers safety motivation. In this study I hypothesize that supervisors' proactive personality and three Big Five traits will be positively related to workers' safety climate perceptions. In addition, I hypothesize that four Big Five traits in workers will be positively related to workers safety motivation. Finally, I hypothesize that group-

level safety climate will be significantly related to individual-level safety motivation after controlling for workers' personality.

Participants in this study were maintenance and construction workers from a municipal city bureau, in 28 workgroups, totaling 146 workers and 28 supervisors. Workgroup sizes vary but averaged 6.21 members, including the supervisor. The data were collected in small groups (paper-and-pencil) and electronically (on-line); workers and supervisors answered questionnaire items on personality variables, safety climate, safety motivation, safety behaviors, and safety outcomes. In addition, archival data on safety outcomes were collected. The data were analyzed using a combination of multiple regression, multi-level modeling, and path analysis to test hypotheses and answer research questions.

Both proactive personality and Big Five traits in supervisors accounted for incremental variance in aggregated workgroup safety climate over controls. In addition, workgroup safety climate and individual workers' cautiousness were significant predictors of workgroup safety motivation in a hierarchical linear model. At the individual level of the model, only the traits of cautiousness and morality were significant predictors of individual safety motivation. Tests of the Neal and Griffin (2004) model showed that safety motivation partially mediated the relationship between individual safety climate and safety participation behaviors. In addition, safety motivation fully mediated the relationships between morality and both safety compliance and safety participation behaviors. Finally, safety motivation partially

mediated the relationship between cautiousness and both safety compliance and safety participation behaviors.

The results suggest that supervisor personality can have an effect on the on workgroup safety climate perceptions. In addition, this study provided evidence that Big Five traits are useful predictors of the antecedents of accidents and injuries. Suggestions for training managers and future research are also discussed.

Table of Contents

List of Tables

List of Figures

Chapter I

Introduction

While occupational injuries, illnesses, and fatalities have long been a concern to organizations, they have become central organizational issues since the passage of the Occupational Safety and Health Act of 1970. In 2009 there were 3.28 million non-fatal occupational injuries and illnesses (Bureau of Labor Statistics, 2010). Of these injuries and illnesses, 965,000 resulted in lost days from work. The incidence rate for non-fatal injuries and illnesses was 3.6 per 100 workers, which is the lowest rate since 2003. Occupational illnesses were much less common than injuries accounting for slightly more than 5% of the 3.28 million non-fatal occupational injuries and illnesses. In addition, there were 4,340 occupational fatalities in 2009, which represents a decrease from the 5,214 occupational fatalities in 2008.

The Liberty Mutual Research Institute for Safety publishes the annual Workplace Safety Index which identifies the leading causes of the most disabling injuries in the United States, and estimates the direct costs of these injuries. In 2005, overexertion, falls, bodily reactions to slips and trips not involving falls, and being struck by an object accounted for nearly one-half of all disabling injuries (Liberty Mutual Research Institute for Safety, 2008). The direct costs of these injuries was estimated at $48.3 billion. Indirect costs are difficult to calculate, but they are generally considered to be four times greater than the direct costs (Neville, 1998). If that ratio continues to hold, indirect costs of these disabling injuries would be approximately $193 billion in 2005. Liberty Mutual has also tracked changes in injury

causes and costs from 1998 to 2005. During that time there was an 3.9% increase in inflation adjusted costs even though there was a 21% decrease in the frequency of injuries. Given the number of occupational injuries, illnesses, and fatalities, and the associated direct and indirect costs, it is easy to understand why organizations and society are motivated to improve safety at work.

The passage of the Occupational Safety and Health Act in 1970 also motivated organizations to attend to safety. The act was intended to assure safe and healthful working conditions for all workers, to the extent possible (Cohen & Margolis, 1973). The act created the Occupational Safety and Health Administration (OSHA) and the National Institute for Occupational Safety and Health (NIOSH). OSHA is charged with promulgating and enforcing safety regulations, and providing organizations with training and assistance to achieve safety goals. Literally thousands of pages of safety regulations have been implemented by OSHA, and enforcement activities are ongoing. Despite these efforts, some have argued that OSHA is seriously hampered by a lack of inspectors and a budget that does not keep up with inflation (Peterson & Mayhew, 2005). In addition, although fines for noncompliance with safety regulations can cost organizations tens of thousands of dollars, large companies with profits in the millions of dollars per year *may* not view these fines as a deterrent, but rather as a cost of doing business. Hopefully this occurs infrequently but there is no way of knowing for sure.

In 1989 OSHA published voluntary safety and health program management guidelines which describe the four elements of effective safety and health programs. The first element is management commitment and employee involvement, which are

viewed as complimentary. Commitment from management provides the motivating force and resources for organizing and controlling safety activities, while employee involvement allows workers to develop and express their commitment to safety and health. Second is worksite analysis to identify existing hazards and conditions/work processes which could create hazards. Third is hazard prevention and control. Once identified, hazards should ideally be removed, but failing this engineering and administrative controls can reduce workers exposure to hazards. For example, placing guards on moving machine parts is an engineering control, while regulating the amount of time workers are exposed to toxic chemicals would be an administrative control. As a last resort, employees can be issued personal protective equipment (PPE), such as hard hats and safety glasses, to protect them from hazards. The final element is safety and health training which addresses the safety and health responsibilities of all personnel. Safety and health programs have resulted in significant reductions of injuries through engineering and work design interventions, but some safety professionals, after reaching a point of diminishing returns, began to focus on organizational influences on safety and health (Shannon, Mayr, & Haines, 1997).

Researchers from around the globe have studied the effects of organizational, social, and psychological variables on safety and health. For example, Barling, Loughlin, and Kelloway (2002) reported on the positive effects of safety-specific transformation leadership on safety outcomes. Several studies have examined the effects of organizational safety culture on accidents (Cox & Flin, 1998; Havold, 2005; Mearns & Flin, 2001), while Zohar (1980, 2002, 2003a) is most often associated with

studies of the effect of work-group safety climate on accidents and injuries. A number of other studies have examined the relationship between a variety of workers' individual differences and accidents/injuries, including demographic differences such as age and sex (Karson & O'Dell, 1974; Goldenhar, Williams, & Swanson, 2003), job tenure (Cooper & Phillips, 2004), accident history (Cree & Kelloway, 1997) and personality traits (Arthur & Graziano, 1996; Wallace & Chen, 2006).

While all of these studies have led to valuable insights and interventions to improve occupational safety (e.g. Zohar, 2002), the role of the unit-level supervisor appears to be especially important. According to Zohar (2000) it is the unit-level supervisor who is most responsible for conveying the importance of safety to his or her subordinates. However, I am unaware of any studies that have examined the personality characteristics of supervisors that are associated with the development of a positive safety climate at the work-group level. In addition, while several studies have examined the relationship between broad measures of workers' personality (e.g. The Five Factor Model) and safety outcomes, I am unaware of any studies that have related workers' trait-level personality to safety-related perceptions, motivation, behaviors, or accidents/injuries. Similarly, the effect of newer personality constructs such as proactive personality (Bateman & Crant, 1993) on safety outcomes have not been examined. The current study seeks to address these gaps in the literature.

The primary aim of this dissertation is to test the influence of workgroup supervisors' personality traits on workgroup safety climate. Specifically, it is posited that supervisors with a proactive personality will foster a stronger, more positive

group-level safety climate relative to supervisors without a proactive personality, if they perceive that safety is important to the organization. In addition, it is expected that three personality traits, friendliness, cheerfulness, and altruism will relate to supervisors' ability to foster a strong, positive group-level safety climate.

It is also expected that personality traits of workers' will have a direct effect on workers' safety motivation. Specifically, two traits of conscientiousness (order and deliberation) and two traits of agreeableness (altruism and trust) are expected to affect safety motivation. Hypotheses will be tested with a multilevel model based on Neal and Griffin (2004). Figure 1 depicts the model. Level one of the model is at the individual worker level and encompasses individual safety motivation, two types of safety behaviors, and safety outcomes (accidents, injuries, near misses). Level two consists of safety climate perceptions at the workgroup level and supervisors' personality.

Chapter II

Safety Climate

In the quarter century since Zohar (1980) described the construct of safety climate there has been a plethora of research across the globe, and in several industrial sectors. A number of factors may account for this activity. First, while safety professionals had made great strides in reducing accidents and injuries through engineering and work design interventions, they began to reach a point of diminishing returns (Shannon, Mayr, & Haines, 1997). This prompted researchers to examine organizational influences on safety outcomes. In addition, a systems perspective began to replace the focus on accident-prone or careless individuals (Dekker, 2002). In this view human error and accidents are jointly caused by people, job tasks, and the work environment. Organizations began moving away from a control-oriented approach to accident reduction, which emphasized safety rule enforcement and punishment, to a more strategic approach which encourages workers to identify with the organizational goals and expend the effort needed to achieve them (Barling and Hutchinson, 2000). As such, safety climate has proved to be a powerful proactive management tool which can be used to focus interventions, establish benchmarks, and provide information on safety problems before accidents occur (Coyle, Sleeman, & Adams, 1995; Seo, Torabi, Blair, & Ellis, 2004).

Safety climate also overcomes some of the limitations of traditional measures of safety performance such as lost time accidents, which occur too infrequently to provide information on safety conditions across work sites, do not evaluate risks to

workers, and often violate distributional assumptions of commonly used statistical methods (Seo, et al., 2004). Accidents and injuries are considered a lagging indicator of safety, which can only indicate the presence of dangers and failures of the safety system.

In contrast, safety climate is considered a leading indicator of safety which measures workers perceptions and attitudes about the level and priority of safety at work (Mearns, Whitaker, & Flin, 2001). In other words, safety climate can alert organizations to potential safety problems before they occur. In a meta-analytic review of the relationship between safety climate and safety performance Clarke (2006a) found safety climate was strongly related to safety compliance and safety performance, and these safety behaviors showed small but reliable relationships with safety outcomes like accidents across different industrial settings. Safety climate also predicted accidents in prospective studies.

This chapter will review safety climate research. I will begin by comparing and contrasting climate and culture, discussing definition and measurement issues involving safety climate and safety culture, and finally, review a model of safety behavior and outcomes in which safety climate is hypothesized to play a major role. Evidence for the importance of unit-level supervisors in the establishment of a positive safety climate will be highlighted throughout, as supervisors' personality has not previously been related to the development of unit-level safety climate.

Culture and Climate

A number of authors have discussed the confusion in the literature between the constructs of culture and climate (e.g. Denison, 1996; Mearns & Flin, 2001) and how each should be measured. For example, Moran and Volkwein (1992) defined culture as the assumptions, expectations, and outlooks taken for granted by organizational members. Culture is not easily observable by outsiders, but can be inferred from the shared norms, values, and meanings of the group. In contrast, they define climate as attitudes and behaviors that are directly observable. Similarly, Denison (1996) suggests that culture reflects the evolved context in which the work situation is embedded. It is rooted in the history of the organization and difficult to manipulate directly. He defines climate as the thoughts, feelings, and behaviors of organizational members. Climate is more temporal and subjective, and can be manipulated by people with power and influence, such as immediate supervisors. Schneider and Gunnarson (1991) suggest that culture reflects the assumptions, values and philosophies about human nature and the role of work in life, while climate consists of practices, procedures, and reinforced behaviors at work. In their view, culture tells *why* things happen in an organization, and climate tells *what* happens in organizations. Finally, Mearns and Flin (2001) define culture as a complex, enduring trait of organizations which reflects fundamental values, norms, assumptions, and expectations. They define climate as employee's perceptions, attitudes, and beliefs about specific work-related behaviors. In summary, culture is a more abstract and implicit construct which applies to the organization as a whole, while climate tends to be more specific and explicit,

and applies to subgroups within the organization. However, as Denison (1996) notes, both culture and climate relate to the internal social environment of organizations, and the terms are often used interchangeably. The two constructs also tend to be measured differently.

Wiegmann, Zhang, von Thaden, Sharma, and Gibbons (2004) discuss two perspectives on organizational culture, the socioanthropological and organizational psychology perspectives. While the definitions of culture from each perspective are very similar, the methods and purpose of measuring culture differ. In the socioanthropological perspective culture is typically measured qualitatively through ethnographic approaches, observations, and employee interviews. The purpose is to describe the culture, which is considered too complex to manipulate. In the organizational psychology perspective culture is measured quantitatively using questionnaires, with the goal of manipulating the culture. In his review Denison (1996) concludes that culture tends to be measured using qualitative methods and climate tends to be measured using quantitative methods.

Safety Culture and Safety Climate

Like culture and climate in general, the constructs *safety culture* and *safety climate* have often been used interchangeably and tend to be poorly defined. Mearns and Flin (2001) define safety culture as the values, beliefs, attitudes, social mores, norms, rules, practices, competencies, and behaviors related to safety in the organization. This is a broad definition which may have limited scientific utility (Cox & Cox, 1996). In their review of safety culture literature, Wiegmann, et al. (2004) list

seven commonalities among safety culture definitions: 1) Safety culture is defined at the group level or higher (i.e. it refers to all group or organizational members); 2) Safety culture is concerned with formal safety issues including management and supervisory systems; 3) Safety culture emphasizes contributions from all employees; 4) Safety culture impacts employees work behavior; 5) Safety culture is reflected in reward contingencies; 6) Safety culture reflects the willingness of the organization to develop and learn from errors, incidents, and accidents; and, 7) Safety culture is enduring, stable, and resistant to change. Even though these commonalities suggest that safety culture is on the same abstract level as organizational culture, they tend to be measured differently.

Wiegmann, et al. also suggest five indicators of the level of safety culture in an organization. The first is organizational commitment[1] which comes from upper level management and refers to the degree to which safety is a core value or guiding principle in the organization. Second, management involvement refers to the extent to which both upper- and mid-level managers are personally involved in critical safety activities. Third, employee empowerment reflects employees' power to make decisions and take responsibility for safety at work. Fourth is reward systems for safe behaviors. The final indicator is reporting systems which refers to having a reporting culture which encourages employees to report problems and learn from mistakes. In other words, there are no negative consequences or reprisals for reporting safety

[1] Organizational commitment in this case is not equivalent to the employee attitude of organizational commitment (Allen & Meyer, 1990; Meyer & Herscovitch, 2001).

problems. When considered from the perspective of the unit-level supervisor, these indicators of organizational safety culture could also be used to infer expected behaviors and outcomes for themselves and their subordinates. This process of 'sense making' occurs as new employees strive to determine which behaviors, attitudes, and perceptions tend to be important, required, and/or rewarded in the workplace. When upper management expresses commitment to safety and works to improve safety this tells unit-level supervisors that safety is important in the organization, and there are likely to be consequences for safety outcomes. Reporting systems and a culture of learning from mistakes also reinforces the importance of safety to the organization. Similarly, empowering workers and a reward system for safe behaviors rely directly on the attention and behavior of unit-level supervisors. These behaviors help workers to understand the importance of safety to the organization and their supervisor, and to act accordingly.

The Definition of Safety Climate

Zohar (1980) defined climate as the "summary of molar perceptions that employees share about their work environments" (p. 96). An organization can have multiple climates, for example for safety or customer service, which tell employees what behaviors are expected and rewarded in their work unit. Specific climates are derived from the broader organizational climate as employees in discrete work units observe the implementation of organization-wide policies and procedures by their immediate supervisors. Climate perceptions come from the observation of practices as patterns, with pattern-level properties, rather than specific incidents, as the main

determinant (Zohar and Luria, 2005). Safety climate refers to workers perceptions of the relative priority of safety in their work unit.

According to Zohar (1980; 2000; 2003a) individual climate perceptions should be aggregated to the level of naturally occurring groups in the organization. For aggregation to the group level to be meaningful, there must be within-group homogeneity of climate perceptions. Zohar refers to this internal consistency as *climate strength*. On the other hand, *climate level* refers to the valence or direction of the climate perceptions (e.g. high or low priority for safety). Since there is variability between work unit supervisors in their implementation of organizational policies and procedures, it is likely that there will be between-unit variability in climate level. Researchers have used a variety of methods to justify aggregation of individual perceptions to the unit-level.

Bliese (2000) describes three criteria to determine the appropriateness of aggregating individual perceptions to the unit-level: Within-group homogeneity, between-group variance, and naturally occurring units of analysis (e.g. work-groups). To establish within-group agreement or homogeneity one must show that responses from group members are more similar than expected by chance (Klein, Dansereau, & Hall, 1994). Researchers have commonly used two methods to demonstrate within-group agreement. First, they have compared within-group variance to a theoretical distribution of random variance by computing r_{wg} (for single items) or $r_{wg(j)}$ (for multiple item scales; James, Demaree, & Wolf, 1984, 1993). Usually the comparison distribution is a rectangular distribution which assumes that all responses on the

response scale are equally likely. This ignores the likelihood of biased responding which occurs when individuals use a restricted range of the response scale. While most researchers continue to use the rectangular comparison distribution, other options have been discussed (James et al., 1984, 1993; Bliese, 2000). The second commonly used method is to use an ANOVA to contrast within- and between-group variances. For example, if we measured safety climate in five work-groups we can conduct a one-way ANOVA using work-group as a factor to make the comparison. From the results of the ANOVA we can calculate two types of intraclass correlations (ICC; Shrout & Fleiss, 1979) and determine if there is a significant between-groups effect. The ICC(1) reflects the proportion of total variance explained by group membership (Shrout & Fleiss, 1979; Bryk & Raudenbush, 1992), and if greater than zero suggests contextual (i.e. group) effects are present (Bliese, 2000). The ICC(2) estimates the reliability of the group means (Bliese, 2000). Both are used to establish within-group homogeneity of variance. In addition, a significant between-groups effect from the ANOVA demonstrates between-group variability on the measure of interest. There are numerous examples in the literature of researchers using r_{wg} or $r_{wg(j)}$, ICC(1), ICC(2), and ANOVA results to justify aggregation of individual responses to the group level (e.g. Hofmann & Mark, 2006; Hofmann & Stetzer, 1996, 1998; Katz-Navon, Naveh, & Stern, 2005; Wallace, Popp, & Mondore, 2006; Zohar & Luria, 2005). The third criterion, naturally occurring units of analysis, is determined logically by the researcher. For example, it would make little sense to aggregate the individual perceptions of workers randomly selected from different work groups because of the

theoretical importance of managers' behaviors at the unit-level in determining the level of safety climate.

The Safety Climate Construct

Since Zohar (1980) first developed a measure of safety climate, researchers have struggled to define a homogeneous factor structure for safety climate scales. Zohar reported the results of a principle components factor analysis (exploratory) of his initial scale which identified eight factors: importance of safety training programs, management attitudes toward safety, effects of safe conduct on promotion, level of risk at the workplace, effects of required work pace on safety, status of the safety officer, effects of safe conduct on social status, and status of the safety committee. He concluded that there were two main first-order factors for his scale which together accounted for 60% of the variance in safety climate scores: 1) Management attitudes about safety; and, 2) Relevance of safety in the production process. Brown and Holmes (1986) attempted to cross-validate the Zohar (1980) scale using a confirmatory factor analysis and found three factors: management concern for employee well-being, management safety activities, and employees' perceptions of physical risk at work. Similarly, Dedobbeleer and Beland (1991) found only two factors using a 9-item version of the Zohar (1980) scale: management commitment to safety and worker involvement in safety.

Several studies in different industrial sectors and countries have reported different factor structures for safety climate scales (Cheyne, Oliver, Tomas, & Cox, 2002; Coyle, Sleeman, & Adams, 1995; Diaz & Cabrara, 1997; Gaba, Singer, Sinaiko,

Bowen & Ciaverelli, 2003; Glendon & Litherland, 2001; Huang, Ho, Smith, & Chen, 2006; Lee & Harrison, 2000; Lu & Shang, 2005; Mearns, Flin, Gordon, & Fleming, 1998; Mearns, Whitaker, & Flin, 2001; Niskanen, 1994; Seo, et al. 2004; Silva, Lima, & Baptista, 2004; Varonen & Mattila, 2000; Williamson, Feyer, Cairns, & Biancotti, 1997; Wills, Watson, & Biggs, 2006). However, most studies have found four to six factors (Fullarton & Stokes, 2007). Seo et al. (2004) suggest one possible reason for this myriad of factor structures is the common use of orthogonal extraction. They produced the first consistent factor structure across studies by allowing their two main factors (management commitment to safety and supervisor support for safety) to cross-load using an oblique rotation after an orthogonal rotation showed that management commitment influences some of the indicators of supervisor support and vice versa.

After reviewing the literature, a number of authors have proposed generic or core factors for safety climate scales. These include: 1) Management commitment to safety and employee well-being (Cox & Flin, 1998; Flin, Mearns, O'Connor, & Bryden, 2000; Lu & Shang, 2005; Oliver, Cheyne, Tomas, & Cox, 2002), 2) Management and organizational practices related to safety systems (Flin, et al., 2000; Neal, Griffin, & Hart, 2000), 3) Open communication and employee involvement in workplace safety and health (Lu & Shang, 2005; Neal, Griffin, & Hart, 2000), and 4) Production pressure (Flin et al., 2000). In addition, several authors have reported a higher-order safety climate factor that accounts for a variety of first-order factors (Barling, et al., 2002; Hofmann & Stetzer, 1996; Neal & Griffin, 2004). In

their meta-analysis, Beus, Payne, Bergman, and Arthur (2010) found that perceived management commitment to safety was the most robust predictor of injuries.

Zohar's (1980, 2000; Zohar & Luria, 2005) definition of safety climate as shared perceptions of the relative importance of safety at work, as defined by practices as patterns, maps onto these generic or core safety climate scale factors. At both the organizational- and unit-levels, management/supervisor commitment to safety, and actions related to the safety and health of employees, and the level of production pressure, lead to patterns of behavior that indicate the relative priority of safety at work. Similarly, open communication between management and subordinates about safety issues, and employee involvement in workplace safety and health are practices that reflect the priority of safety as well as the social nature of most organizations.

Zohar's Multilevel Model of Safety Climate

Zohar and colleagues (Zohar, 1980, 2000, 2003a; Zohar & Luria, 2003, 2005) take a slightly different approach with their multi-level model of climate. They focus on two levels of climate, the organizational level and unit- or workgroup level. In this model the unit-level climate partially mediates the effect of organizational climate on behavior-outcome expectancies. According to Zohar, climate reflects socially construed indicators of desired role behavior. Employees form climate perceptions from policies and procedures put in place by upper-level management, and from the actions of their immediate supervisor. Policies and procedures are the primary referent for organizational climate, while the practices of the immediate supervisor are the primary referent for unit-level climate. As hypothesized in the model, organizational

climate has a direct effect on behavior-outcome expectancies and unit-level safety climate. Safety climate also has a direct effect on behavior-outcome expectancies. Figure 2 shows a schematic of Zohar's multilevel model.

Additionally, organizational climate should be positively related to unit climate because policies and procedures set boundaries on supervisors' discretionary behaviors. However, there will still be variability in unit-level climate perceptions because policies and procedures do not cover every conceivable situation. Therefore, supervisors will have some discretion in implementing policies and procedures. Similarly, conflicts between production and safety in different work groups, differences in relating to subordinates (e.g. LMX; Liden & Maslyn, 1989), and differences in supervisors beliefs and attributions regarding safe behavior, will also lead to different levels of unit safety climate between workgroups (Zohar & Luria, 2005).

For Zohar (1980; 2000; Zohar & Luria, 2005), safety climate refers to attributions about policies and procedures, and supervisory practices that indicate the priority of safety at work. Employees try to make sense of the workplace and determine what role behaviors are desirable. In this sense-making process workers tend to focus on patterns of behavior over time, rather than specific incidents of behavior, to determine which role behaviors are desired and rewarded by the organization. Since the immediate supervisor is the most proximate representative of the organization to most workers, patterns of supervisor behavior will be a major determinate of workers perceptions of the relative importance of safety at work.

Additionally, for policies and procedures to be effective they must be associated with consequences. In Zohar's model, consequences for desirable behavior occur at both the organizational and unit levels. At the organizational level, consequences include annual performance evaluations, pay raises, and job transfers. At the unit level, consequences are related to the immediate supervisor's frequency and intensity of monitoring safety behaviors and responding to safety issues. Unit-level consequences include informal feedback from the supervisor, shift/job allocations, and formal commendations. Several studies suggest that unit-level consequences have a stronger effect on employee behavior than organizational-level consequences (Simard & Marchand, 1995, 1997; Stajkovic & Luthans, 1997, 2001).

Zohar has published three successful tests of the model. The first study (Zohar, 2000) found support for safety climate as a group-level phenomenon among 53 work groups in a single manufacturing company using a newly developed measure of safety climate. He found within-group homogeneity of workers' perceptions of their supervisor's safety practices. In addition, he showed between-group variance in worker's perceptions. In other words, Zohar demonstrated high safety climate strength and variations in safety climate level. He also developed a new outcome measure–microaccidents–which are minor injuries requiring medical attention that do not result in lost workdays. Finally, he showed that unit-level safety climate scores predicted microaccidents.

In the second study (Zohar & Luria, 2003), the authors attempted to improve safety by changing supervisors' behavior. The intervention occurred at both the

organizational and unit levels. Unit-level supervisors received weekly feedback on the frequency of their safety-oriented interactions with their subordinates. In addition, higher-level managers received this same information as well as data on the frequency of workers' safety behaviors in the different work groups. Stated differently, the authors attempted to improve safety climate at both the organizational and unit levels through the provision of safety-specific feedback. The intervention produced an increase in unit-level supervisors' safety-oriented interactions with subordinates. Additionally, the intervention produced an increase in workers' safety behaviors and in unit-level safety climate scores. This study highlights the importance of managers' safety-related behaviors in improving safety behaviors in the workgroup. More specifically, this study shows the positive effects of increasing the frequency and intensity of managers' monitoring of, and response to safety issues.

In the final study (Zohar & Luria, 2005) the authors tested their multilevel model with over 400 workgroups in 36 manufacturing plants across several industrial sectors. The authors reported that the strengths and levels of safety climate at the organizational and unit levels were positively related. This illustrates the importance of procedural coherence, meaning that the goals and values espoused by the organization are congruent with the policies and procedures promulgated by upper management. Such procedural coherence creates a strong situation for unit-level supervisors and results in a positive relationship between the strengths and levels of organizational climate and unit-level climate. However, the relationship was stronger for climate levels than climate strengths. In addition, the authors found that the

relationship between the strengths of the organizational climate and the unit-level climate were moderated by the degree of routinization and formalization of work tasks. Specifically, as job tasks become more routine and formalized, direct supervisors have less discretion over how work is accomplished, and thus, organizational climate strength has a greater effect on unit-level climate strength. Between-group variability in unit-level safety climate strength was negatively related to both organizational climate strength and the amount or routinization and formalization of work tasks. In other words, a strong organizational climate and/or routine/formal job tasks results in less variability between work groups in safety climate strength (similarity of work group members' perceptions). This study explicates the sense-making activities of workers as a group, showing that people pay attention to both the organizational-level (policy and procedures) and unit-level (supervisor behaviors) stimuli to detect practices as patterns and determine the relative priority of safety in their organization.

Taken together these three studies provide good support for Zohar's (2003a) model. As predicted, safety climate scores showed within-unit homogeneity and between-unit variance. In addition, Zohar demonstrated that organizational climate strength and the amount of routinization/formalization of work act as boundary conditions by decreasing immediate supervisors' discretion when implementing safety policies and procedures.

Importantly, these studies also show the effect of managers' behaviors for safety in the workplace. When unit-level managers received feedback on their safety-related behaviors with subordinates, and feedback from upper-level management on

safety outcomes and safety behaviors, safety-related interactions with subordinates and unit-level safety climate scores both increased. This suggests that unit-level supervisors also engage in sense-making activities to determine the relative priority of safety versus production. Finally, between-unit variability in safety climate level and strength also suggests that supervisors will vary in their ability to foster a coherent, positive safety climate. Zohar (2003a) discusses a number of variables that effect supervisor safety practices (superior's goals, discretion level, job characteristics, and leadership style) all of which are likely to vary across unit-level supervisors within the same organization. Another variable that is also likely to vary across supervisors is personality, which is not presented in Zohar's model.

Safety Climate Literature Review

In addition to the studies by Zohar and colleagues (Zohar, 2000; Zohar & Luria, 2003; 2005) discussed above, safety climate has been studied around the world and in several industrial sectors. These studies have produced consistent results across jobs, industrial sectors, and countries of origin. The majority of studies have been conducted on workers in the United States (Cooper & Phillips, 2004; DeJoy, Schaffer, Wilson, Vandenberg, & Butts, 2004; Gaba, Singer, Sinaiko, Bowen, & Ciaverelli, 2003; Goldenhar, Williams, & Swanson, 2003; Hofmann & Mark, 2006; Hofmann & Morgeson, 1999; Hofmann, Morgeson, & Gerras, 2003; Hofmann & Stetzer, 1996, 1998; Huang, Chen, Krauss, & Rodgers, 2004; Huang, Ho, Smith, & Chen, 2006; Huang, Shaw, & Chen, 2004; Janssens, Brett, & Smith, 1995; McGovern, Vesley, Kochevar, Gershon, Rhame, & Anderson, 2000; Prussia, Brown, & Willis, 2003; Seo

et al., 2004; Smith, Huang, Ho, & Chen, 2006; Wallace & Chen, 2006; Wallace, Popp, & Mondore, 2006; Watson, Scott, Bishop, & Turnbeaugh, 2005). In addition, workers in several European countries have participated including those in the United Kingdom (Cheyne, Cox, Oliver, & Tomas, 1998; Cheyne, Oliver, Tomas, & Cox, 2002; Mearns, Flin, Gordon, & Fleming, 1998; Mearns, Rundmo, Flin, Gordon, & Fleming, 2004; Mearns, Whitaker, & Flin, 2001, 2003), France (Cheyne, Cox, Oliver, & Tomas, 1998; Janssens, Brett, & Smith, 1995), Spain (Diaz & Cabrera, 1997), Norway (Havold, 2005), Denmark (Nielsen, Carstensen, & Rasmussen, 2006), Portugal (Silva, Lima, & Baptista, 2004), and Finland (Varonen & Mattila, 2000). Filling out the list are participants from Australia (Coyle, Sleeman, & Adams, 1995; Fogarty, 2005; Fullarton & Stokes, 2007; Griffin & Neal, 2000; Neal & Griffin, 2006; Neal, Griffin, & Hart, 2000), Israel (Katz-Navon, Neveh, & Stern, 2005; Naveh, Katz-Navon, & Stern, 2005; Zohar, 1980, 2000, 2002; Zohar & Luria, 2003, 2005), Canada (Barling & Hutchinson, 2000; Barling, Loughlin, & Kelloway, 2002; Kelloway, Mullen, & Francis, 2006; Zacharatos, Barling, & Iverson, 2005), and Hong Kong (Siu, Phillips, & Leung, 2004). These studies are summarized in Table 1.

The types of industrial sectors studied shows similar diversity including manufacturing (Brown & Holmes, 1986; Cheyne, Cox, Oliver, & Tomas, 1998; Cheyne, Oliver, Tomas, & Cox, 2002; Clarke, 2006b; Cooper & Phillips, 2004; Griffin & Neal, 2000; Hofmann & Morgeson, 1999; Nielsen, Carstensen, & Rasmussen, 2006; Prussia, Brown, & Willis, 2003; Watson, Scott, Bishop, & Turnbeaugh, 2005; Zacharatos, Barling, & Iverson, 2005; Zohar, 1980, 2000, 2002;

Zohar & Luria, 2005), construction (Dedobbeleer & Beland, 1991; Gillen, Baltz, Gassel, Kirsch, & Vaccaro, 2002; Gillen, Faucett, Beaumont, & McLaughlin, 1997; Goldenhar, Williams, & Swanson, 2003; Matilla, Rantanen, & Hytinnen, 1994; Siu, Phillips, & Leung, 2004), health care (Gershon, et al., 1998; Katz-Navon, Naveh, & Stern, 2005; Gaba, Singer, Sinaiko, Bowen, & Ciavarelli, 2003; Hofmann & Mark, 2006; McGovern et al., 2000; Naveh, Katz-Navon, & Stern, 2005; Neal & Griffin, 2006; Neal, Griffin, & Hart, 2000; Schaefer & Moos, 1996), offshore oil rigs (Mearns, Flin, Gordon, & Fleming, 1998; Mearns, Rundmo, Flin, Gordon, & Fleming, 2004; Mearns, Whitaker, & Flin, 2001, 2003), shipping and transportation (Havold, 2005; Huang, Chen, Krauss, & Rodgers, 2004; Wallace, Popp, & Mondore, 2006), maintenance (Wallace & Chen, 2006; Zohar, 2002), high reliability industrial sectors such as naval pilots (Gaba, Singer, Sinaiko, Bowen, & Ciavarelli, 2003) and chemical processing (Hofmann & Stetzer, 1996), wood processing (Varonen & Mattila, 2000), airport ground handling (Diaz & Cabrera, 1997), utility workers (Hofmann & Stetzer, 1998), clerical/service (Coyle, Sleeman, & Adams, 1995), retail (DeJoy, Schaffer, Wilson, Vandenberg, & Butts, 2004), road administration (Niskanen, 1994), military personnel (Hofmann, Morgeson, & Gerras, 2003), and several studies sampling across industrial sectors (Huang, Ho, Smith, & Chen, 2006; Huang, Shaw, & Chen, 2004; Smith, Huang, Ho, & Chen, 2006; Zacharatos, Barling, & Iverson, 2005). These studies are summarized in Table 2. The remainder of this review will focus on safety climate antecedents and outcomes.

Safety Climate Antecedents

An examination of Zohar's (2003a) multilevel model suggests that organizational climate and supervisory safety practices are the most proximal antecedents of unit-level safety climate. Distal antecedents include enforced safety policies, and characteristics of the job and supervisor, specifically, job tasks and technology, and supervisors' goals, discretion, and leadership style.

Organizational climate. Zohar and Luria (2005) showed that organizational climate and unit-level climate were positively related, but that the effect was moderated by the degree of routinization and formalization of work processes, which limits the discretion of unit-level supervisors. Several other authors have also documented the relationship between organizational climate and unit-level safety climate. DeJoy, Schaffer, Wilson, Vandenberg, and Butts (2004) found that general organizational climate accounted for incremental variance in safety climate scores at the individual-level, after controlling for demographics. Neal, Griffin, and Hart (2000) reported that organizational climate was positively related to safety climate at the individual-level. Wallace, Popp, and Mondore (2006) reported a strong relationship between foundation climates (organizational support and management-employee relations) and safety climate at the unit-level. Finally, Naveh, Katz-Navon, and Stern (2005) examined the relationships among four safety climate dimensions: suitability of safety procedures in daily work, safety information flow, managerial safety practices, and organizational priority for safety. They found that suitability of safety procedures

and safety information flow were directly related to the priority of safety, however, managerial safety practices were not.

Supervisor safety practices. As discussed above, Zohar and Luria (2003) showed that increasing the frequency and intensity of manager's monitoring of, and response to safety issues led to increases in unit-level safety climate. This study also showed the effect of safety-related feedback from upper level managers on unit-level managers' behavior. Zohar and Luria showed that unit-level supervisors' safety related interactions with workers increased when both the supervisors and the upper-level managers received feedback on the number of safety-related interactions and safety outcomes.

Several other safety intervention studies also illustrate the effect of supervisors' safety practices at the unit-level, and enforcement of safety policies at the organizational-level. Cooper and Phillips (2004) studied the effect of a behavioral safety initiative on safety climate and accidents. Workers were trained to monitor and record co-workers safe behaviors for one year. The initiative resulted in an increase in the level of safety climate perceptions and a reduction of accidents. Nielsen, Carstensen, and Rasmussen (2006) conducted a 3-year longitudinal study of the effects of an incident reporting scheme in two Danish metal production plants. Workers at the plants were required to report three types of incidents: lost-time injuries (more than one day of absence), minor injuries (less than one day of absence), and near misses. This information was then used to develop preventive measures. They found that the level of safety climate increased in both plants over the course of

the study. Finally, Mearns, Whitaker, and Flin (2001) used benchmarking as an intervention to improve the safety climate in nine North Sea oil and gas installations in a two-year longitudinal study. Safety climate levels showed considerable variability across installations during the first year, but then converged in the second year of the study.

In summary, these studies suggest that a concern for safety by managers at all levels leads to improvements in safety climate. However, they do not detail the characteristics and behaviors of managers which lead to improvements in safety climate, or the specific mechanisms involved.

Leadership style. Studies of the effect of leadership style on safety climate begin to fill these gaps. Barling, Loughlin, and Kelloway (2002) argued that each of the four components of transformational leadership (Bass, 1998) are relevant to occupational safety. Transformational leaders are high in idealized influence and can convey safety as a core value of the organization. Their ability to inspire others can motivate employees to work for the collective good. These leaders also provide intellectual stimulation which can lead to thinking in new ways and confronting old assumptions in order to improve safety. Lastly, individual consideration in their relationships with subordinates leads to active interest in employee welfare and well-being. They found that safety-specific transformational leadership by direct supervisors, safety consciousness (awareness of safety issues and knowledge of safe behaviors), and role overload all predicted safety climate at the individual-level. Similarly, Kelloway, Mullen, and Francis (2006) examined the effects of safety-

specific leadership style (transformational vs. passive) in direct supervisors, and safety consciousness on safety climate at the individual level. As predicted, transformational leadership was positively associated with safety climate, and passive leadership was negatively associated with safety climate. Safety consciousness partially mediated these effects.

Mullen and Kelloway (2009) found that safety-specific transformational leadership training had affected both leaders and workers. Leaders showed an increase in safety attitudes, intentions to promote safety, and in self-efficacy related to their ability to improve safety. Workers showed an increase in safety participation behaviors and safety climate perceptions. In a similar study, Kines, Anderson, Spangenberg, Mikkelsen, and Zohar (2010) provided construction supervisors with training to increase the proportion of safety-related communications with workers after finding that only 6-16% of supervisor-worker communications had a safety-related component. Following training, safety-related communications between supervisors and workers increased along with workers' safety behaviors.

Receiving safety-related messages from more than one leader also appears to have a greater affect on safety than receiving only a single-source safety message. Newman and Griffin (2008) examined individual and leader effects on driving accidents. On the individual level, drivers' safety motivation was negatively related to motor vehicle accidents. At the leader level, drivers' perceptions of fleet managers' safety values had a larger effect on drivers' safety motivation than perceptions of their

direct supervisor's safety values. However, perceptions of supervisors' and fleet managers' safety values interacted to increase safety motivation in drivers.

These studies show the importance of group-level managers' active efforts to improve safety through valuing, encouraging, coaching, and rewarding safe behaviors in subordinates. Managers who are able to convince employees that safety is important to the organization and the work-team members, and motivate them to conduct work in a safe manner tend to foster a more positive safety climate at the unit-level. Safety climate leads to more safety motivation and knowledge, safer working behaviors, and reduced accidents and injuries.

In addition some researchers have examined the relationship between leader-member exchange (LMX) and safety climate. High quality LMX relationships are characterized by loyalty, positive affect, mutual contributions toward work goals, and professional respect, between supervisors and subordinates (Liden & Maslyn, 1998). Hofmann and Morgeson (1999) investigate the relationship between perceived organizational support (POS; Eisenberger, Huntington, Hutchinson, & Sowa, 1986) and LMX on accidents, as mediated by supervisors' levels of safety communication and safety commitment. They reasoned that both POS and LMX would be positively related to the level of safety communications by supervisors, as the former conveys the organization's valuing of employees and the latter, by definition, involves open and constructive communication. Taking a social exchange perspective (Blau, 1964) they predicted that both would invoke the norm of reciprocity (Gouldner, 1960) with POS leading to more pro-organizational behaviors and LMX leading to more pro-

leader behaviors. Their path analysis confirmed that both POS and LMX were negatively related to accidents, with the relationship being fully mediated by the levels of direct-supervisors' safety communication and safety commitment. They concluded that the backing of upper management is needed for direct supervisors to successfully convey both organizational and supervisor support to their subordinates, and improve safety outcomes.

Similarly, Hofmann, Morgeson, and Geras (2003) examined the effect of safety climate on the relationship between LMX, safety citizenship role definitions, and safety citizenship behaviors. Again, taking the social exchange perspective they predicted that high quality LMX relationships would increase subordinates' desire to reciprocate with leader-valued behaviors. When supervisors work to create a positive safety climate their subordinates are more likely to view safe behaviors as important and valued. The authors found that safety climate moderated the relationship between LMX and safety citizenship role definitions. When the level of safety climate was low LMX had no effect on safety citizenship role definitions. However, when the level of safety climate was high, subordinates in high-quality LMX relationships adopted more safety citizenship role definitions than subordinates in low-quality LMX relationships. As predicted, safety citizenship role definitions were positively related to safety citizenship behaviors. The authors concluded that safety climate defines important organizational behaviors and LMX predicts the degree of subordinate reciprocity. These studies show the effect of positive social exchange relationships on safety motivation. Managers who form high-quality LMX relationships with subordinates are

more likely to also facilitate a positive safety climate, which increases subordinates' motivation and ability (knowledge) to work safely.

Zohar (2003b) suggests that the same values upon which reciprocity is based–trust, openness, loyalty, and positive affect–also encourage leaders to focus on safety rather than short-term production pressures. In other words, the values and behaviors common high-quality LMX relationships lead to a positive safety climate. In addition, recent studies highlight the importance of trust in leaders for safety outcomes. Conchie and Burns (2009) found that workers' trust in different information sources about safety were due to different factors. Trust in project managers, safety managers, government sources, and co-workers was based on the accuracy of the source. In contrast, trust in supervisors was based on demonstrations of caring. This has implications for the delivery of training, which the authors suggest is largely performed by supervisors. In a similar study, Conchie and Donald (2009) found that safety-specific trust in leaders moderated the relationship between safety-specific transformational leadership and workers safety citizenship behaviors. At high and moderate levels of trust safety-specific transformational leadership significantly increased workers' safety citizenship behaviors, but not at low levels of trust. Finally, Luria (2010) found that trust in management was negatively related to injuries and positively related to safety climate strength and level.

Zohar does not consider the effect of individual difference variables in supervisors on the development of safety climate. However, relevant to this dissertation, there is some evidence that individual differences affect the development

of LMX relationships. For example, the match between supervisor and subordinate positive and negative affectivity was positively related to the development and quality of LMX relationships (Bauer & Green, 1996; Engle & Lord, 1997). Similarly, in their review, Graen and Uhl-Bien (1995) conclude that "(the) development of LMX relationships is influenced by characteristics and behaviors of leaders and members and occurs through a role-making process" (p. 229). This suggests that the same individual differences in supervisors which lead to high quality social exchange relationships with subordinates are likely to contribute to the formation of a positive safety climate.

The work environment. Characteristics of the work environment have also been found to affect safety climate. For example, consider high reliability process industries (e.g. nuclear energy and chemical processing industries) which have little room for error. Gaba, Singer, Sinaiko, Bowen, and Ciaverelli (2003) compared safety climate perceptions between naval aviators and health care workers. They reasoned that naval aviation is a high-reliability process industry. Therefore, naval aviators should report stronger safety climate perceptions than health care workers. The authors counted the number of problematic responses–those that suggest a lack of safety climate–for the two groups of workers. In addition, the authors divided the health care workers into groups based on hospital department, e.g. emergency room, operating room. As predicted, Gaba et al. found that only 5.6% of the aviators' responses were problematic versus 17.5% of hospital workers' in general and 20.9% of hospital workers' in high hazard departments such as the emergency room and operating room.

Similarly, Zacharatos, Barling, and Iverson (2005) studied safety in high-performance work systems, which refers to an interconnected set of human resource practices (e.g. recruitment, selection, development, motivating, and retaining employees, and compensation contingent on safe performance) with the emphasis on employees as a primary competitive advantage. They found a high-performance work system showed a strong positive relationship with safety climate at the individual level, as well as trust in management. Finally, Gillen, Baltz, Gassel, Kirsch, and Vaccaro (2002) examined the safety climate perceptions of construction workers who had experienced a non-fatal fall in a cross-sectional study. After dividing the injured workers into union and non-union groups, differences in safety climate perceptions in the two groups were examined. Overall, union workers reported more positive safety climate perceptions than non-union workers.

The work environment is not limited to the physical characteristics of the workspace or work processes. Social aspects of the work environment can also have an effect on safety climate. For example, Luria (2008) found that safety climate strength was influenced by both leadership style and social cohesion in the work groups as group members work together to understand their leader's priorities. Similarly, Zohar and Tenne-Gazit (2008) found that the relationship between transformational leadership and safety climate strength was partially mediated by the proportion of workers who engage in work-related social exchanges, and by the proportion of workers who have established friendships. The proportion of friendships in workgroups also had a positive direct effect on safety climate strength. Finally,

Tucker, Chmiel, Turner, Hershcovis, and Stride (2008) found that the relationship between perceived organizational support for safety and worker's safety voice (being willing to talk about safety problems) was fully mediated by workers' perceptions of co-workers support for safety.

Summary of safety climate antecedents. Taken together, these studies confirm the antecedent relationships hypothesized in Zohar's (2003a) multilevel model. To wit, organizational climate and supervisor safety practices are proximal antecedents of unit-level safety climate. In addition, distal antecedents such as immediate superior's goals, supervisor discretion level, job characteristics, and leadership style affect unit-level safety climate through their effect on supervisor safety practices. Although Zohar's model does not specify an effect for individual differences in supervisors, such differences could well have an effect on supervisor goals and leadership style. Personality traits which help supervisors form positive social relationships with subordinates and convey personal and organizational concern for workers' welfare and well-being are likely to result in positive social exchanges and increase subordinates' motivation to reciprocate. As Hofmann, Morgeson, and Geras (2003) suggest, the relationship between supervisors and subordinates provides the motivation to reciprocate, and a focus on safety defines the behaviors valued by the organization.

Safety Climate Outcomes

According to Zohar's (2003a) multilevel model, organizational climate and safety climate lead to behavior-outcome expectancies, safety behaviors, accident/injury incidence, and health outcomes. As mentioned previously, safety

climate is considered a leading indicator of the state of safety in an organization. In other words, it should be predictive of expectancies, behaviors, and "hard" outcomes. Indeed, several studies have documented a relationship between safety climate and accidents (Cooper & Phillips, 2004; Mearns, Flin, Gordon, & Fleming, 1998; Mearns, Whitaker, & Flin, 2003, 2003; Seo et al., 2004; Silva, Lima, & Baptista, 2004; Varonen & Mattila, 2000; Wallace et al., 2006; Zohar, 2000). Regarding injuries, Hofmann and Mark (2006) found a relationship between safety climate at the unit-level and back injuries in nurses. Gillen et al. (2002) found that individual-level safety climate accounted for unique variance in injury severity. Lastly, Huang, Chen, Krauss, and Rogers (2004) reported that the quality of the execution of corporate safety policies was negatively related to injury risk and injury incidence. Four studies reported a relationship between safety climate and near misses (Seo et al., 2004), safety events (Barling et al., 2002; Kelloway et al., 2006), and safety incidents (Zacharatos et al., 2005). Unfortunately, most of these studies did not aggregate safety climate perceptions to the unit-level, and a variety of safety climate measures were used. Likewise, most of these studies are cross-sectional in nature leaving causal relationships unclear. In her meta-analysis Clarke (2006a) concluded that safety climate shows a small and unreliable relationship with accidents, and only predicts accidents in prospective (longitudinal) studies. She also found that safety climate was strongly related with safety behaviors (compliance and participation; Griffin & Neal, 2000), and that these safety behaviors showed small but reliable relationships with

safety outcomes. Finally, she concluded that the relationship between safety behaviors and safety outcomes was consistent across settings.

Several other studies have also found that safety climate is related to a variety of safety behaviors including PPE compliance (McGovern et al., 2000), self-reported at risk behaviors (Watson et al., 2005), medication errors (Hofmann & Mark, 2006), treatment errors (Naveh et al., 2005), unsafe behaviors (Clarke, 2006b), a variety of driving behaviors including driver distraction, traffic violations, driver errors, and pre-trip vehicle maintenance (Wills, Watson, & Biggs, 2006), and, safety compliance behaviors and safety participation behaviors (Clarke, 2006a).

In addition, safety climate shows relationships with a number of perceptions, attitudes, cognitions, and feelings. Rundmo (2001) found safety climate was negatively related to the acceptability of safety rule violations. Similarly, Watson et al. (2005) found safety climate was negatively related to the perceived safety of the work environment. Safety climate is positively related to job satisfaction (Hofmann & Mark, 2006; Siu et al., 2004), safety knowledge and safety motivation (Neal, et al., 2000; Neal & Griffin, 2006), individual responsibility for safety (Cheyne, et al., 1998, 2002), and prevention focus (Wallace & Chen, 2006). Finally, three studies have found relationships between safety climate and psychological and/or physical strain (Fogarty, 2005; Goldenhar, Williams, & Swanson, 2003; Siu, et al., 2004).

Summary of Safety Climate Outcomes

As predicted by Zohar's (2003a) model, these studies show that safety climate is related to accidents, injuries, near misses, and safety-related events/incidents. In

addition, safety climate is related to a variety of safety behaviors, attitudes, perceptions, cognitions, and feelings of physical and psychological strain. The weight of the evidence supports the notion of safety climate as a leading indicator of the state of safety in an organization or work group. In other words, organizations can use safety climate to determine if and where safety improvement interventions are needed, and to assess the effectiveness of safety interventions whether they occur at the organizational level or the workgroup level.

Safety climate studies also point to the importance of the unit-level supervisor in the development of the workgroup safety climate. Zohar and colleagues (2000; Zohar & Luria, 2005) have shown within-workgroup consistency and between-group variability in safety climate perceptions. They have also shown that certain boundary conditions such as organizational climate and routinization/formalization of work decrease supervisors' discretion in the implementation of unit-level safety climate. In addition, studies of leadership styles and leader-member exchange illustrate the importance of the unit-level supervisor (Barling, et al., 2002; Conchie & Donald, 2009; Hofmann, & Morgeson, 1999; Hofmann, Morgeson, & Gerras, 2003; Kelloway, et al., 2006; Kines, et al., 2010; Mullen & Kelloway, 2009; Newman & Griffin, 2008). A safety-specific transformation leadership style leads to group-level managers' active efforts to improve safety through valuing, encouraging, coaching, and rewarding safe behaviors in subordinates. Similarly, managers who form high-quality LMX relationships with subordinates are more likely to also facilitate a positive safety climate. High-quality LMX relationships also increase subordinates' desire to

reciprocate, and a positive safety climate defines which behaviors are valued by the supervisor and the organization, leading to safety-related behaviors by subordinates. Finally, behaviors associated with a transactional leadership style such as monitoring, providing feedback and reinforcement, modeling and coaching are also related to safety behaviors in subordinates (Kines, et al., 2010; Mullen & Kelloway, 2009; Maierhofer, Griffin, & Sheehan, 2000) and positive safety climates (Zohar, 2003b). Considered together, the research suggests that unit-level supervisors are a crux in the development of workgroup safety climate. The effect of organizational-level safety climate on workers behaviors is mediated, at least partially, by unit-level supervisors who implement safety policies and procedures, and in doing so convey the relative importance of safety to their subordinates. However, individual differences in supervisors and workers that affect safety at work are not accounted for in Zohar's model. In the next chapter I will review the literature on individual differences and safety.

Chapter III

Individual Differences and Accidents

Given the large economic and social costs of work-related accidents and injuries it is not surprising that organizations strive to reduce them (Barling & Frone, 2004). Many of these efforts have been directed towards the four levels of hazard control: hazard removal, engineering controls, administrative controls, and personal protective equipment (Kaminski, 2001). Even though some researchers have suggested that 90% of accidents can be attributed to human error (McKenna, 1983), the study of the relationship between individual differences and accidents and injuries has received less attention. Rather, most safety researchers have focused on organizational influences to further reduce the costs of occupational accidents and injuries (Shannon, Mayr, & Haines, 1997). Landy and Conte (2004) describe the personnel approach to reducing accidents and injuries. This approach involves finding individual differences related to accidents and injuries and using that information when making decisions about hiring and job placement.

Hansen (1988) discusses a number of individual difference variables that could be related to accidents and injuries. These include physical characteristics of workers, education, marital status, perceptual and mental abilities, and personality traits. In their model of factors that contribute to workplace accidents, Sanders and McCormick (1993) suggest that a variety of worker characteristics mediate the effects of organizational factors, the physical environment, equipment design, the design of work, and the social-psychological environment on unsafe behavior and accidents.

They list a variety of worker characteristics including ability level, personality, motivation, and off-the-job pressures and distractions. Other authors (e.g. George, 1992) suggest that individual differences like personality traits moderate the effects of the situation on individual states and behaviors.

This chapter will review the research on a number of different individual difference variables that are related to accidents and injuries in the workplace. This review will begin by examining the constructs of accident proneness and differential accident liability. Following this, research on the relationship between several individual difference variables (locus of control, impulsivity, trait affect, cognitive failures, and personality traits) and accidents and injuries will be reviewed. Next, a review of the bandwidth-fidelity dilemma leads to an argument for trait-level predictors of safety outcomes. The focus then shifts to studies of individual differences in managers and workers, and their relationship with important organizational outcomes including accidents and injuries. Next, I review the research on proactive personality (Bateman & Crant, 1993) and argue that managers with a proactive personality will produce better safety outcomes in their work groups than those without. The chapter concludes with a discussion of trait-level personality variables in supervisors and workers that should relate to safety outcomes.

Accident Proneness and Differential Accident Involvement

Safety researchers began studying accident proneness in the early 20th century (Greenwood & Woods, 1919; as cited in McKenna, 1983) and over the years a variety of definitions have been put forth. In general the construct of accident proneness

assumes that certain individuals are more likely to have accidents than others (Landy & Conte, 2004). Hansen (1988) described five assumptions common to most definitions of the construct: a) Accident proneness is a personality trait or syndrome; most researchers have considered it to be a unitary trait; b) Accident proneness is innate or inherent; c) Accident proneness is stable across time; d) Accident proneness causes workers to have accidents, and; e) Accident prone workers will have multiple accidents. However, the history of accident proneness is as controversial as it is long, and today it is no longer considered a viable construct. According to McKenna (1983) the reasons for this are threefold. First, accident proneness is based on flawed statistical reasoning. Secondly, accident proneness lacks an accepted definition. Finally, and most importantly, the assumptions underlying the construct have received little empirical support. I will address each of these concerns in turn.

Greenwood and Wood (1919) put forth the statistical reasoning to demonstrate the existence of accident prone individuals. They reasoned that if all workers have an equal probability of having an accident then accidents would be described by a Poisson distribution. However, if the probability of having an accident was not equivalent across workers then accidents would be distributed as a negative binomial distribution, which usually occurs. The problem lies in the fact that other variables can result in a negative binomial distribution of accidents. For example, non-personal factors such as exposure to risk, biases in reporting, and even prior accident involvement (McKenna, 1983). Therefore, the fact that accidents are described by the

negative binomial distribution does not necessarily suggest that an individual difference between workers is responsible.

The second problem with the construct of the accident prone personality is the variety of definitions and assumptions in the different statements of the theory (Hansen, 1988; McKenna, 1983). For example, sometimes accident proneness is viewed as a unitary trait, while at other times it is thought to involve multiple psychological factors. In addition, accident proneness presents a tautology. Accident proneness is defined by a pattern of accident involvement on the one hand, while at the same time it is viewed as the cause of accidents. This type of circular reasoning tells us nothing about how workers with an accident prone personality differ from those without.

Finally, there is little empirical support for the construct of accident proneness. McKenna (1983) reviewed the research and described several negative findings. For example, if individuals have an accident prone personality, then there should be a high correlation between the number of accidents they suffer at two points in time. However, in these studies the correlations are usually low and do not account for differential risk exposure. Accident proneness is also thought to be a general characteristic which will manifest itself across situations. In other words, people who are accident prone at work will be so at home, and this will be reflected in the number of accidents. Once again, the limited data do not support this assumption. Accident proneness has also been viewed as innate and immutable. There is little support for this hypothesis and it can lead organizations to neglect other causes of accidents, like

the work environment, which can be modified. Finally, the idea that most accidents are caused by a few people has been used to support the accident proneness construct. McKenna suggests that this is not necessarily true, and is in fact likely to occur by chance.

Despite these problems with the accident prone personality, researchers have discovered that some individual differences are associated with higher accident rates. McKenna (1983) suggests that researchers focus on differential accident involvement, a construct which requires fewer assumptions, is less judgmental, and is easier to define. Essentially, differential accident involvement entails using psychological tests to predict accidents. It allows for changes over time and circumstances, unlike accident proneness which was thought to be stable. For example, a worker going through a divorce may have a higher probability of being in an accident, but only while the stressor is present. This allows researchers to study both personal and non-personal factors related to accident involvement. The focus of this review will now turn to the individual difference variables that have been shown to be related to accidents.

Individual Differences and Accidents

Researchers have examined the relationship between a number of individual difference variables and accidents. These include locus of control, impulsivity, trait affect, cognitive failures, and personality traits. In this section I will briefly review these lines of research while focusing mostly on the Big Five personality factors and traits.

Locus of control. A number of researchers have examined the relationship between locus of control (Rotter, 1966) and accidents. Mayer and Treat (1977) found that locus of control was more external for participants in their high accident group than their low accident group. Jones and Wuebker (1985) developed the Safety Locus of Control scale from Rotter's original scale. They found that externals reported more accidents than internals and those who scored in the middle range. In their meta-analysis, Arthur, Barrett, and Alexander (1991) reported that internal locus of control was negatively related to accidents. Similarly, in his review Hansen (1988) concluded that locus of control was related to accidents. People with an external locus of control are not likely to believe that they can do anything to prevent accidents, will expend little effort to do so, and should have a higher probability of having an accident. Conversely, people with an internal locus of control are likely to believe that they can prevent accidents, will expend effort to prevent accidents (behave safely), and are less likely to have an accident.

Impulsivity. A smaller number of researchers have examined the relationship between impulsivity and accidents. Reynolds and Schiffbauer (2004) present a rational for the hypothesized relationship. They argue that one tendency of impulsive individuals is to discount consequences which are not immediate. In the safety arena, impulsive individuals will tend to discount the negative consequences (i.e. accidents, injuries) of their unsafe behaviors, as well as the benefits of safe practices. Dahlen, Martin, Ragan, and Kuhlman (2005) found that impulsivity, sensation seeking, and boredom proneness accounted for unique variance in predicting unsafe driving

behaviors. Similarly, in his review Hansen (1988) concluded that impulsivity is consistently related to accidents.

Trait affect. Iverson and Erwin (1997) examined the relationships between positive and negative affect and occupational injuries while controlling for demographics and quality of work life factors. *Positive affectivity* refers to the disposition to perceive situations in a positive and enthusiastic manner (George, 1989; Judge, 1993). On the other hand, *negative affectivity* refers to the tendency to perceive situations and experiences negatively, and to experience negative emotions (Watson, Clark, & Tellegen, 1988). In addition, self-report ratings of positive and negative affectivity tend to be stable over time (Levin & Stokes, 1989) and are thus considered dispositional or trait-like.

People with high scores on positive affectivity tend to have more self-efficacy and to seek more active control over their environments (George, 1989; George & Brief, 1992), which should lead to more task engagement and fewer injuries. In addition, people high in positive affectivity tend to be more systematic in their decision making (Staw & Barsade, 1993) which should lead to more in-depth and careful appraisals of situations and fewer accidents. On the other hand, people high in negative affectivity tend to have more attention lapses and distractibility on the job (Hansen, 1989) which should make them less engaged in work tasks and more susceptible to accidents. They are also less likely to seek control over their environment (Judge, 1993) and more likely to engage in emotion-focused coping (Parkes, 1986; 1990), which should increase their accident potential.

In their study, Iverson and Erwin (1997) found that positive affectivity was negatively related to occupational injuries, while negative affectivity was positively related to injuries. Their study also shows the importance of the work environment in predicting injuries. Their best predictor of injury in this blue collar sample was work routinization, which showed a strong negative relationship. Supervisor and co-worker support also showed inverse relationships with injuries. The authors suggest that even though extreme extraversion is associated with injuries, some characteristics of extraversion such as enthusiasm and self-efficacy may help prevent occupational injuries.

Cognitive failure. Research on the measurement and correlates of cognitive failure has increased over the past twenty years. Reason (1988) discusses two classes of failures. The first are planning failures in which the individual chooses the wrong course of action. The second are execution or cognitive failures in which the individual fails to correctly perform the intended action. Reason suggests that people who experience a high level of cognitive failures may have a rigid attentional focus which prevents them from processing information in novel or dynamic situations. Cognitive failures have been defined as cognitively-based mistakes or failures of performance of an action that a person is normally capable of performing (Martin, 1983; Wallace, Kass, & Stanny, 2002). The tendency for cognitive failures is usually viewed as dispositional or trait-like (Broadbent, Cooper, Fitzgerald, & Parkes, 1982) and is expected to vary across individuals.

Common examples of cognitive failures include celebrating when the opposing team scores (Norman, 1981), forgetting appointments (Larson & Merritt, 1991), and pouring cream into coffee when the customer requested it black. Reason (1984) suggests that cognitive failures tend to occur when tasks are automated or when a person's attention is distracted by internal or external stimuli. Similarly, Robertson, Manly, Andrade, Baddeley, and Yiend (1997) suggests that cognitive failures occur under conditions of boredom, worry, or divided attention.

Broadbent, et al. (1982) developed the Cognitive Failures Questionnaire (CFQ) to measure the frequency of errors in three areas: perception, memory and motor functions. The authors suggested that the CFQ measures a general cognitive factor that includes perceptual, memory and motor functions. However, other researchers have found the CFQ consists of several factors (e.g. Larson, Alderton, Neideffer, & Underhill, 1997). Wallace, Kass, and Stanny (2002) conducted a principle components analysis of CFQ scores and found four internally consistent factors: memory, distractibility (attention errors), blunders (execution errors), and memory for names.

A number of correlates of CFQ scores have been reported in the literature. Cognitive failures are negatively related to memory performance (Martin, 1983) and sustained attention (Robertson et al., 1997). Wallace, Kass, and Stanny (2002) found that the memory factor of the CFQ predicted performance in "go" situations in which a response is required at the correct time. They suggest that people who score high on the memory factor are less likely to respond when necessary. Cognitive failures are also positively related to absentmindedness (Reason & Lucas, 1984), self-

consciousness and social anxiety (Houston, 1989), and, boredom proneness and daytime sleepiness (Wallace, Kass, & Stanny, 2002; Wallace, Vodanovich, & Restino, 2003).

A few studies have examined the relationship between cognitive failures and accidents. Larson and Merritt (1991) found a positive relationship between cognitive failures and driving accidents after controlling for the most extreme "bad" driving records. Larson et al. (1997) found a positive correlation between cognitive failures and work accidents in military personnel. Similarly, Wallace and Vodanovich (2003b) reported that the CFQ Blunder factor predicted automobile accidents, work accidents, and job performance. Wallace and Vodanovich (2003a) found that cognitive failures were positively correlated with unsafe behaviors and accidents, and negatively correlated with conscientiousness. In addition, cognitive failures accounted for unique variance over conscientiousness in predicting unsafe behaviors and accidents. Finally, they found that cognitive failures moderated the relationship between conscientiousness, and unsafe behaviors and accidents. In their sample, the impact of cognitive failures on unsafe behaviors and accidents was greater for individuals low in conscientiousness relative to those high in conscientiousness. This suggests that people who experience more cognitive failures also engage in more off task behavior which leads to unsafe behaviors and accidents.

Demographic variables. Demographic variables are usually measured by researchers to describe their sample and also to use as control variables in analyses. Hansen (1988) suggests personality researchers should control for age, experience and

gender when trying to predict accidents. Typically, demographic variables do not show significant relationships with accidents and injuries (e.g. Arthur, Barrett, & Alexander, 1991; Arthur & Graziano, 1996; Hansen, 1989; Iverson & Erwin, 1997). However, there are exceptions. For example, Dahlen, Martin, Ragan, and Kuhlman (2005) found that women received fewer moving violation tickets than men, and younger drivers reported more risky driving than older drivers. Iverson and Erwin (1997) reported that gender was negatively related to accidents—women had fewer—but age, education, and tenure were not. Finally, Hansen (1989) reported that accident risk fully mediated the relationship between tenure and accidents. The most common control variables used in studies of individual differences and accidents are age, gender, education, and job tenure.

Big Five personality factors. Industrial psychologists have long been interested in the relationship between personality traits and work outcomes (see Barrick & Mount, 1991). Barrick and Mount (1995) describe the prototypical characteristics of the Big Five factors. Extraversion is characterized by talkativeness, sociability, assertiveness, adventurousness, and high energy level. Agreeableness encompasses cooperativeness, caring for others, flexibility, trust in and tolerance for others, courtesy, and cheerfulness. Conscientiousness refers to taking responsibility, acting in an orderly and well-planned manner, being careful, perseverance, and a hard work achievement-orientation. Neuroticism is characterized by emotionality, tension, anxiety, nervousness, excitability, anger, and apprehension. Openness to Experience

refers to imagination, artistic sensitivity, intellectual curiosity, independence, and broad interests.

However, less attention has been paid to personality traits as predictors of occupational safety. For example, Arthur and Graziano (1996) examined the relationship between Five Factor Model (McCrae & Costa, 1987; Goldberg, 1992, 1993) personality traits and driving accidents in two samples. They found that conscientiousness showed small but reliable inverse relationships with at-fault driving accidents and moving violations. In addition, when participants were dichotomized into accident and no-accident groups, the latter had significantly higher conscientiousness scores. Similarly, in their study of undergraduates, Cellar, Nelson, and Yorke (2001) found that conscientiousness was inversely related to both not-at-fault accidents (r = -.14) and total accidents (r = -.16). Agreeableness was also inversely related to total accidents (r = -.13). In addition, they found that conscientiousness was the only significant predictor of not-at-fault and total accidents. However, the effect size was small (R^2 ~ .02). Finally, Wallace and Chen (2006) found that conscientiousness was positively related with safety performance, but the relationship was fully mediated by regulatory focus. The same mediated relationship was found for production focus as well.

Two meta-analyses (Clarke & Robertson, 2005; 2008) examined the relationships between Big Five personality factors and accident involvement. The best predictor of accident involvement in these two studies was low agreeableness. Estimated true score correlation coefficients between low agreeableness and accidents

ranged from ρ = .26 - .44. More importantly, low agreeableness was the only Big Five factor determined to be valid and generalizable in both meta-analyses. In addition, estimated true score correlations for low conscientiousness ranged from ρ = .27 - .31 (valid and generalizable in 2005 but not 2008). The authors also reported that extraversion was a valid and generalizable predictor of traffic accidents (2005), and neuroticism was a valid and generalizable predictor of accidents, depending on the situation (2008). In addition, a meta-analysis by Christian, Bradley, Wallace, and Burke (2009) showed that conscientiousness was significantly (ρ = .16) related to safety motivation.

Other personality taxonomies. Lardent (1991) examined differences in 16PF (Cattell, Eber, & Tatsuoka, 1980) profiles between military fighter pilots who had crashed and those who had not. Pilots who crashed were more conscientious and self-sufficient, and less suspicious, shrewd, and tense. Lardent suggested that the unique personality profiles of fighter pilots and their strict adherence to within-group norms might explain the counterintuitive relationship between conscientiousness and crashes. A number of studies have also examined the relationships between the Eysenkian personality traits of extroversion and neuroticism (Eysenck & Eysenck, 1975), as measured at the national level, and accidents. Several studies have found positive relationships between neuroticism and extroversion, and accidents (Lajunen, 2001; Lester, 2000; Lynn & Hampson, 1975). Ozkan and Lajunen (2007) found extroversion measured at the national level was positively related to traffic fatalities. Finally, in his review Hansen (1988) concluded that extroversion was strongly related to accidents.

These studies document reliable relationships between conscientiousness, extroversion, neuroticism, agreeableness, and accidents at the level of the individual worker. However, that has not always been the case. For example, Salgado (2002) in his meta-analysis did not find any of the Big Five factors were predictive of accidents. In addition, the bivariate correlations between personality traits and accidents are often small (e.g. $r \sim |.15|$), and there are a number of environmental and demographic variables that moderate the relationships. Nevertheless, it does appear that people who score high on conscientiousness tend to have fewer accidents, while people who score high on extroversion and neuroticism tend to have more accidents.

To summarize, the literature on individual differences and occupational safety suggests that individual workers characterized by conscientiousness, agreeableness, internal locus of control, positive affectivity and low cognitive failures are least likely to experience accidents and injuries at work. Such individuals are able to focus on their work tasks, believe they can affect their environment and make efforts to do so, and are not easily distracted by external or internal stimuli. On the other hand, individuals characterized by high extroversion and neuroticism, low agreeableness, external locus of control, negative affectivity, and high cognitive failures are more likely to have accidents and injuries. These individuals have difficulty focusing on their work tasks, are easily distracted by external and internal stimuli, and tend not to believe they can affect their environment. The negative effects of these characteristics are likely to be exacerbated by stressful work situations such as increased production pressure or negative social interactions with supervisors and co-workers. Demographic

variables are not usually related to accidents or injuries, although there are a few exceptions in the literature. In the next section I will discuss bandwidth-fidelity considerations when predicting behavior, leading to an argument for the use of trait-level predictors of safety outcomes for supervisors and workers.

Bandwidth-Fidelity Considerations in the Prediction of Behavior

The bandwidth-fidelity dilemma (Cronbach & Gleser, 1965) refers to the choice to measure either a single narrowly defined trait, or a more broadly defined factor such as the Big Five factors. The main concern for I/O psychologists is which level of measurement specificity leads to better prediction of job performance, and facilitates an explanation of the mechanisms of behavior and the development of theories of job performance (Ones & Viswesvaran, 1996). Broad traits such as the Big Five have high cross-situational reliability and predictive validity (Barrick & Mount, 1991; Stewart, 1999; Tett, Jackson, & Rothstein, 1991) and they have been used successfully to predict broad criteria like overall job performance. It is possible for narrow traits to show higher predictive validity than broad factors if the unique variance of the narrow traits is related to the performance criteria of interest. However, Ones and Viswesvaran (1996) suggest that trait specific variance is not usually related to job performance either within or across situations. Therefore, they argue that when predicting overall job performance (a broad criterion) factor-level measures are likely to be more useful than trait-level measures.

Another advantage of broad measures relative to narrow measures is higher reliability. There is a direct relationship between internal consistency (coefficient α)

and the length of the scale. In general, factor-level scales are longer than trait-level scales and show higher reliability coefficients. However, several authors have argued that the increased reliability of factor scales must be balanced against the loss of trait-specific variance which might be predictive of the criterion (Ashton, 1998; Paunonen, 1998; Schneider, Hough, & Dunnette, 1996). In other words, depending on the criterion, aggregating trait-level scores to the factor-level may dilute or cancel out specific trait-level variance shared with the criterion (Saucier & Ostendorf, 1999), thereby reducing predictive validity. Psychometrically, reliability only defines the upper limit of validity, but does not ensure validity (Gatewood, Feild, & Barrick, 2007).

Typically, the choice of the bandwidth of a predictor depends on the bandwidth of the criterion. In general, the best prediction is expected when the bandwidths of the predictor and the criterion match (Schmidt & Kaplan, 1971; Hogan & Roberts, 1996; Paunonen & Ashton, 2001a). Ones and Viswesvaran (1996) argue that most criteria used to predict work-related outcomes are based on broad samples of behavior gathered over time, for example, supervisor ratings of overall job performance. Therefore, a broad bandwidth predictor will usually be preferable. In addition, choosing predictors based on theory, empirical results, or a job analysis should improve validity even more (Hogan & Roberts, 1996). However, not everyone agrees; some authors have concluded that homogeneous traits are preferable when predicting work-related outcomes.

Paunonen, Rothstein, and Jackson (1999) agree with Ones and Viswesvaran that predicting broad, complex criteria may require a broad bandwidth measure. However, rather than use the Big Five factors, they advocate using several trait-level predictors, chosen on theoretical or rational grounds, and combining them into a composite using cross-validated regression weights. For example, Schneider et al. (1996) note that integrity and customer service orientation are composites of narrow traits that show increased predictive validity over the Big Five factors. Others have suggested that the best predictive validity will be achieved when combining trait-specific variance with factor-level variance (Paunonen & Ashton, 2001a; Stewart, 1999).

Ones and Viswesvaran (1996) also discuss practical considerations in the choice of predictors. They argue that even if a narrow measure shows incremental validity over a broad measure in predicting job performance, the utility of the narrow measure will depend on how well it predicts performance for a wide variety of jobs. Since they assume that the validity of narrow predictors will not generalize across jobs they conclude that with limited resources in mind, organizations may not find it cost-effective to pursue increased predictive validity for a small set of jobs.

In summary, there is some disagreement over the usefulness of trait-level personality variables in predicting organizational outcomes. Logically, there is no reason that a broad bandwidth predictor cannot predict a narrow bandwidth criterion, or vice versa. In this same vein, Ones and Viswesvaran (1996) suggest that bandwidth and fidelity are not always on opposite ends of the same continuum. Meta-analytic

studies (Barrick & Mount, 1991; Tett, Jackson, & Rothstein, 1991) provide evidence that broad bandwidth measures are good predictors of overall job performance (a broad bandwidth criteria). However, despite the wide spread use of overall job performance as a criterion in selection and performance evaluation, there may be other criteria of interest to organizations. For example, Ones and Viswesvaran (1996) suggest that trait-level measures are likely to be useful in a developmental or training context. There is considerable agreement among researchers that the bandwidth of the predictor and criterion should match (e.g. Hogan & Holland, 2003), and that predictive validity is maximized when predictors are chosen based on theory, empirical results, or a job analysis (Tett, et al., 1991). Recently researchers have begun to examine the relative predictive and incremental validities of trait-level predictors for a variety of personal and organizational outcomes.

The Predictive Validity of Factors and Traits

Few studies have examined the relative predictive validities of factor-level and trait-level personality measures. The studies presented in this section can be organized based on the criterion type: personal behaviors, academic success, and organizational outcomes (including a single study that examined some safety outcomes). Many of the studies are cross-sectional and rely on correlational and regression analyses, however, several report on multisource data, and two incorporate longitudinal designs. Overall, these studies suggest that trait-level measures can account for unique criterion variance not included in broad factor-level measures. This dissertation is the first study

I am aware of to investigate trait-level predictors of safety outcomes. I will begin this review with the prediction of personal behaviors.

Personal behavior criteria. Three studies (Ashton, Jackson, Paunonen, Helmes, & Rothstein, 1995; Paunonen, 1998; Paunonen & Ashton, 2001a) examined the concurrent validity of factor- and trait-level personality measures on a wide variety of personal behaviors; all three concluded that trait-level measures can, at times, show higher validity than factor-level measures.

Ashton et al. (1995) examined correlations between factor-level measures, trait-level measures, and a variety of personal behaviors (e.g. dating, fraternity interest, smoking, drinking alcohol, bed-making, speaking in class) in a cross-sectional study. Specifically they examined relationships between extraversion and methodicalness (conscientiousness) at the factor-level, three traits of extraversion–affiliation, exhibition, and dominance–three traits of methodicalness–cognitive structure, deliberateness, and order–and a wide variety of specific behaviors and behavioral composites. They found that the trait-level composite of affiliation + exhibition predicted several fun-seeking behaviors (e.g. dating, fraternity interest, smoking, alcohol consumption) slightly better than extraversion. Similarly, the trait-level composite of cognitive structure + deliberateness showed a slightly stronger relationship with specific fun-seeking behaviors than methodicalness. Single trait-level predictors were also predictive of specific behaviors. Dominance was the best predictor of speaking up in class and making complaints, while order was the best predictor of bed-making and keeping one's room clean. Ashton et al. also examined

the relationships with three composite criteria: fun-seeking, tidiness, and surgency. Fun-seeking behaviors were predicted equally well by two trait-level composites: affiliation + exhibition and cognitive structure + deliberateness, and the extraversion factor. Combining composite scores ([affiliation + exhibition] – [cognitive structure + deliberateness]) showed a stronger relation ship with fun-seeking behaviors than a combination of factor-level scores (extraversion – methodicalness). In addition, order showed a stronger relationship with the Tidiness composite than did methodicalness, and dominance showed a stronger relationship with the Surgency composite than did extraversion. Furthermore, the trait-level predictors maintained significant relationships with the criteria even after the factor-level shared variance had been partialled out.

Paunonen (1998) examined the relationship between Big Five factors, traits, and a variety of behaviors (e.g. GPA, dating, smoking, traffic violations, popularity). Both self- and peer-ratings were used in this cross-sectional study. They reported several small to moderate correlations between both types of predictors, and specific behaviors, concluding that both factors and traits account for important criterion variance. They also examined the incremental validity of factors over traits, and vice versa. Both broad factor scores and narrow trait scores showed significant incremental validity relative to each other. However, the incremental validity of the trait measures was greater than that of the factor measures.

Finally, Paunonen and Ashton (2001a) examined correlations between Big Five factors, narrow traits, and 40 different behaviors including health related

behaviors (e.g. smoking, alcohol consumption, obesity), social behaviors (e.g. dating, parties attended), safety related behaviors (e.g. driving fast, traffic violations), intelligence (e.g. general knowledge, numerical ability), college courses and achievement (e.g. GPA, humanities & business classes taken), and peer ratings (e.g. intelligence, popularity, honesty). Once again, both self- and peer-ratings were used in this cross-sectional study. They found that both factors and traits showed several significant correlations with the various criteria, although the trait-level measures accounted for slightly more. Trait-level measures also showed incremental validity over factor-level measures (average = 7.9%) in predicting 11 of the 40 behavioral criteria.

These studies, although they are cross-sectional and exploratory in nature, suggest that narrow trait-level measures account for important criterion variance. At times the trait-level predictors show the only significant relationships with specific or composite behavioral criteria. For some behaviors the trait-level measures and factor-level measures showed equivalent relationships with the behavioral criteria. For other behaviors factor-level measures produced the only significant relationships with the behavioral criteria. In addition, while both factor-level and trait-level measures demonstrated incremental validity relative to each other, the trait-level measures tended to show greater incremental validity. Finally, the strongest relationships were found between composites of trait-level predictors and composites of behaviors. Several authors (e.g. Ashton, et al., 1995; Hough & Schneider, 1996) have argued that the specific variance of trait-level measures could be more predictive than the shared

or common trait-level variance which make up factors. Demonstrations of the incremental validity of traits over factors, and the ability of trait-level measures to maintain significant correlations with criteria even after the factor-level shared variance is partialled out, support this argument.

Academic performance criteria. Two studies of academic performance further highlight the usefulness of narrow traits. Paunonen and Ashton (2001b) examined relationships between two broad factors (conscientiousness and openness to experience), two narrow traits (achievement and need for understanding)–which are traits of conscientiousness and openness respectively–and course grades in an undergraduate psychology class. These predictors were chosen on rational grounds. The study design was longitudinal (one academic term) and multi-source data was gathered (self-reports and TA grading). Both achievement and conscientiousness showed moderate positive relationships with course grades, and did not differ significantly. Similarly, need for understanding showed a moderate positive relationship with course grades but openness to experience was unrelated to grades. The strongest relationship with course grades was for a composite of achievement + need for understanding (r =.31). In contrast, the factor-level composite of conscientiousness + openness to experience showed a relatively weak relationship (r =.15).

In another study of academic performance using a cross-sectional design and multisource data, Rothstein, Paunonen, Rush, & King (1994) examined personality and cognitive predictors of success in graduate business school. The authors measured

two components of academic success: classroom performance and written performance. All personality predictors were chosen on empirical/rational grounds. Only cognitive ability, as measured by the GMAT, predicted written performance. However, three narrow trait measures–achievement, dominance, and exhibition–predicted classroom performance. In addition, the trait-level measures showed incremental validity over cognitive ability in predicting classroom performance ($\Delta R^2 = .12$). None of the Big Five factors predicted either type of academic performance.

In both of these studies personality predictors were chosen on rational grounds to predict academic criteria. Tett, et al. (1991) has suggested that predictive validity can be maximized by choosing predictors on theoretical or rational grounds. In both of these studies, a small number of personality predictors were chosen rationally, and in both studies narrow trait-level predictors performed better than broad factor-level measures. Now I will turn my attention to the few studies examining narrow trait-level predictors of work-related outcomes.

Work-related criteria. Mershon and Gorsuch (1988) examined 16 data sets relating the 16PF (Cattell, Eber, Tatsuoku, 1980) to a variety of work-related criteria, e.g. pay, tenure, supervisor ratings of performance. They computed multiple correlations for each dependent variable based on either six or 16 measures of personality for each data set, then compared the amount of criterion variance accounted for. They found that the 16 narrow trait-level measures accounted for about twice as much criterion variance as the six broad factor-level measures. This study

suggests that narrow trait-level measures can account for important criterion variance above broad factor-level measures. However, this study is still exploratory in nature, and from a statistical point of view, multiple correlations can always be expected to increase as the number of predictors increases.

Moon (2001) examined the relative predictive validity of conscientiousness and two narrower dimensions of conscientiousness–duty and achievement striving–discussed in the literature (e.g. Barrack & Mount, 1995). This experimental study employed a brief longitudinal design (one month). The criterion in this study was participants' choice in an escalation of commitment dilemma. The escalation of commitment dilemma refers the decision to continue expending resources on a losing course of action. Decision makers high in achievement striving are more likely to maintain their commitment to a losing course of action in order to get ahead or maximize self-interest. In contrast, decision makers high in duty will be more likely to abandon a losing course of action for the good of the organization. As predicted, high achievement striving was correlated with an escalation of commitment, while duty showed an inverse relationship. The Big Five factor of conscientiousness was unrelated to escalation of commitment decisions.

Stewart (1999) used a longitudinal design and multisource data to examine the effect of the broad factor conscientiousness and two of its narrower traits–order and achievement–in predicting job performance in the transition and maintenance job stages. He noted that conscientiousness has shown a consistent relationship with job performance in both the transition and maintenance stages. However, he predicted that

order would be a more important predictor in the transition stage because at the start of a new job, organization, structure, and time management help people understand how previously learned behaviors can be applied to the new job. On the other hand, in the maintenance stage achievement becomes more important as job performance in this stage depends more on perseverance and hard work to achieve goals. As expected, conscientiousness showed a consistent relationship with job performance across job stages. However, in the transition stage order was the strongest predictor of performance, while in the maintenance stage achievement was the best predictor of performance. In addition, both order and achievement showed a small (ΔR^2 = .03 - .04) amount of incremental validity over conscientiousness in predicting job performance in the transition and maintenance stages, respectively.

Ashton (1998) examined the relationships of the Big Five factors and the 16 narrow traits from the JPI (Jackson, 1970), and self-reported workplace delinquency (e.g. absenteeism, tardiness, substance use at work, and safety violations) in a cross-sectional study. He found that the factors were slightly less correlated than the narrow traits with workplace delinquency. Nevertheless, conscientiousness showed a significant negative relationships with absenteeism, tardiness, and an overall composite of self-reported workplace delinquency. In addition, agreeableness showed a significant positive relationship with giving away goods and services, and the overall composite of delinquent behaviors. None of the Big Five factors was related to unsafe work behaviors. However, three narrow traits showed small to moderate, but significant, correlations with unsafe behaviors: self-esteem (r = .22), risk-taking

(r = .24), and responsibility (r = -.20).

In her review article Hough (1992) examined several studies that measured personality according to the PDRI nine-factor taxonomy. This taxonomy extends beyond the Five Factor Model by including two personality factors not in the Big Five–Rugged Individualism (masculinity) and Locus of Control–as well as measuring two aspects of both extraversion and conscientiousness. For extraversion the two factors are affiliation and potency, and for conscientiousness the two factors are achievement and dependability. While the author refers to these as factors, other authors have considered them to be facets or trait-level variables subsumed under conscientiousness and extraversion (Barrick & Mount, 1995). Three other PDRI factors account for the rest of the Big Five, Adjustment (neuroticism), Agreeableness, and Intellectance (openness to experience). Hough reports the mean correlations (this is not a meta-analytic review) between the PDRI factors and several measures of job success. She reported that achievement was the best predictor of job proficiency, training success, educational success, and commendable behavior. On the other hand, dependability was the best predictor of law abiding behavior. In addition, she also reported on the best predictors of overall job performance for managers/executives and health care workers. For managers/executives the best predictors of job performance were potency (r = .18) and achievement (r = .18). For health care workers the best predictors were achievement (r = -.24), dependability (r = .24), and agreeableness (r = .19). The author concluded that the Big Five factors are not adequate to predict important life or work outcomes.

Barrick and Mount (1995) conducted a meta-analysis to determine the relative magnitude of relationships between conscientiousness and two of its traits (achievement and dependability) with a variety of work related performance outcomes. Both broadly- and narrowly-defined outcomes were used. They reported that all three personality measures showed stronger relationships with specific narrow criteria than broadly-defined criteria. For example, the meta-analytic correlation coefficients for all global outcomes were: conscientiousness (ρ = .31), achievement (ρ = .33), and dependability (ρ = .30). On the other hand, the coefficients for all specific outcome measures were: conscientiousness (ρ = .40), achievement (ρ = .38), and dependability (ρ = .28). They also found that conscientiousness and its two traits predicted motivation related or "will do" outcomes better than skill related or "can do" outcomes: Conscientiousness (ρ = .26 vs. .13), achievement (ρ = .44 vs. .22), and dependability (ρ = .42 vs. .20), respectively. They concluded that trait-level personality variables can predict better than factor-level variables only when they are conceptually related to the criteria of interest.

Finally, Dudley, Orvis, Lebiecki, and Cortina (2006) conducted a meta-analysis of conscientiousness and four of its narrow traits, achievement, order, cautiousness, and dependability in predicting various types of job performance. In general, they found that the narrow traits showed incremental validity over conscientiousness in predicting job performance. However, the relationships were moderated by the type of job performance and different occupational types. Regarding types of job performance, the trait of achievement was the best predictor of task

behaviors, while dependability best predicted job dedication, interpersonal facilitation, and counterproductive work behaviors (inverse relationship). In addition, narrow traits showed incremental validity over conscientiousness across all types of job performance (ΔR^2s ranged from .037 for overall job performance to .259 for job dedication). As for different types of occupations, narrow traits showed incremental validity over conscientiousness for sales persons, managers, and skilled/unskilled workers, but not for customer service workers. The authors concluded that dependability and achievement drive the relationship between conscientiousness and job performance, with some variation across occupational types.

Summary. Considering the arguments made by Ones and Viswesvaran (1996), what do the results of these studies have to tell us about the relative validities of broad and narrow personality measures in predicting job performance? To recap, Ones and Viswesvaran argued that: a) Trait-level specific variance is not predictive of job performance either within, or across situations; b) Matching the bandwidth of the predictor and criterion is preferable; since most measures of job performance are broadly defined, broad factor-level measures will tend to predict best; c) Broad measures tend to have greater reliability than narrow measures, therefore, the latter will tend to have lower validity; and, d) Even if narrow trait measures do at times show stronger relationships with criteria, most organizations will not find it cost-effective to measure narrow traits because their predictive power does not generalize across jobs. I will consider these arguments in turn.

First, if trait-level specific variance is not predictive of job performance either within or across situations, then it obviously makes sense to use broad factor-level predictors. However, this seems to be an empirical question. Since few studies have been conducted on the predictive validity of trait-level personality measures, I think the conclusion is premature. The studies presented in the present review suggest that narrow trait-level measures are predictive of job performance in some situations. Both Moon's (2001) finding traits predicted decisions in the escalation of commitment dilemma-while Big Five factors did not–and Stewart's (1999) results showing that different traits of conscientiousness were important for job performance depending on tenure on the job, while the broad factor showed a consistent relationship across time, suggest that narrow trait measures can account for important criterion variance within situations. In addition, the review by Hough (1992) and meta-analyses by Barrick and Mount (1995) and Dudley et al. (2006) suggests that narrow trait measures can predict performance across situations. For example, the trait of dependability was the best predictor of three different measures of job performance (job dedication, interpersonal facilitation, and counterproductive work behaviors). In addition, narrow traits showed incremental validity over conscientiousness for three of four occupations (sales, managers, skilled/unskilled workers). A related consideration is the relative criterion validities of broad and narrow personality measures. Examining the reported validities for Big Five factors in two often-cited meta-analyses (Barrick & Mount, 1991; Tett, et al., 1991) reveals low to moderate relationships (*r*s ~ .15 - .30) with work-related outcomes; the trait-level studies presented here show the same magnitude of

relationships. In addition, trait-level composites have shown stronger relationships, even when predicting composite criteria (Ashton, et al., 1995). While it is certain that we will need more research to determine the usefulness of trait-level specific variance in predicting job performance, these studies suggest that such efforts are certainly worthwhile.

Second, although many authors have suggested that predictor and criterion bandwidth should match (e.g. Schmidt & Kaplan, 1971), Ones and Viswesvaran (1996) state this is not necessarily the case. They argue that bandwidth and fidelity are not opposite ends of the same continuum; there is no reason that a broad measure cannot predict a narrow criterion. But the reverse is also true. Dudley, et al. (2006) reported that narrow traits showed incremental validity over conscientiousness for all measures of job performance, even overall job performance (ΔR^2 =.037). One might also to expect that narrow trait predictors chosen on a theoretical or rational basis will demonstrate even stronger relationships (Barrick & Mount, 1995; Paunonen & Ashton, 2001a).

Third, is the argument that broad measures tend to have higher reliabilities–and therefore higher validities–than narrow measures. Since broad measures tend to be longer than narrow measures they will usually show higher internal consistency reliabilities. This tends to be true even though broad measures often have lower item-total correlations than narrow trait measures. However, high reliability does not guarantee any given level of validity. An examination of the reliabilities reported in some of the trait studies cited above (not all studies reported reliability coefficients)

confirms the expected pattern of reliability coefficients. Table 3 shows differences in Cronbach's α and the validity coefficients for broad and narrow measures from four of the studies discussed previously.

As expected estimates of internal consistency tend to be lower for the trait measures than the factor measures. However, in all cases the validity coefficients of the less reliable trait scales are equivalent to, or even exceed those of the more reliable factor scales. Given the negative effect of measurement error on validity, the equivalence of the validity coefficients between trait and factor measures argues for continued research on trait-level predictors of job performance. Some critics of Ones and Viswesvaran (1996; e.g. Paunonen & Ashton, 2001a; 2001b) have argued that trait-level specific variance might compensate for lower reliability when predicting job performance. The studies reviewed here suggest this may be the case.

Finally, Ones and Viswesvaran (1996) argue that most organizations would find little utility in using trait-level predictors of job performance. This is because such narrow measures will tend to be situation- or job-specific predictors, and most organizations have neither the time or money to develop and validate selection criteria for each different job at each location. Once again, the utility of narrow trait measures for predicting job performance is an empirical question that remains unanswered. However, given the research published so far it seems clear that we should continue our inquiries. If narrow measures, or composites of narrow measures, demonstrate a large enough increase in predictive validity over the Big Five factors, the organizational utility of trait-level measures as predictors of job performance could

increase. This may be especially true in the case of safety-related cognitions, attitudes, and behaviors given the high organizational and personal costs of workplace accidents, injuries, and illnesses. Little research has investigated narrow trait-safety outcome relationships. In the next section I will present research on personality variables in supervisors that are related to organizational outcomes.

Manager's Dispositions and Organizational Outcomes

In the early part of the twentieth century the study of leadership focused on the personality traits of leaders. At the time it was believed that leaders were born, not made and therefore researchers searched for traits which characterized the "great man" (Den Hartog & Koopman, 2001). By the 1950s this research stream ran out as researchers failed to find a consistent profile of successful leader traits. However, in the 1970s researchers began to show renewed interest in leader traits and questioned the conclusion that personality traits were not predictive of effective leadership (see Kilpatrick & Locke, 1991; Lord, De Vader, and Allinger, 1986). In his review Yukl (1989) noted several traits that predicted effective leadership (e.g. high energy level, ability to tolerate stress, internal locus of control).

George (1991, 1992) takes the interactional perspective (Bandura, 1986) to explain the relationship between traits, states, behaviors, and organizational outcomes. In her view, traits interact with the situation to produce states which lead to behaviors. Stated differently, states capture the trait-situation interaction. She concludes that traits can be used to predict job attitudes, affective states, and behaviors of managers and

workers. However, only a few studies have specifically examined the relationship between manager's dispositions and subordinates' outcomes.

George and Bettenhausen (1990) examined the relationship between manager's level of positive affectivity (PA; Watson & Tellegen, 1985), and prosocial behavior and turnover intentions in their workgroups. The authors reasoned that managers high in PA would be active, excited, and enthusiastic, and would be perceived as confident, competent, and optimistic. High PA managers would also be more likely to encourage, notice and reward positive subordinate behaviors like prosocial behaviors. Since people usually prefer to work for positive managers and in workgroups with a strong climate for prosocial behavior, turnover intentions in these workgroups should be lower than in workgroups whose managers report lower levels of PA. They found that high PA managers showed more positive mood states which were positively associated with group prosocial behaviors and lower turnover intentions. Similarly, Ganster, Schaubroeck, Sime, and Mayes (1991; as cited in George, 1992) found that subordinates of managers with Type A personality (Friedman & Rosenman, 1974) reported more somatic complaints and depression, and chronic irritation, while subordinates of managers high in negative affectivity (NA) reported less satisfaction with their supervisor.

Staw and Barsade (1993) also looked at the effects of PA on manager's behaviors and peer ratings of managerial performance in assessment center exercises. MBA students were divided into groups (low, medium, and high) based on their level of self-reported PA. Relative to their counterparts in the low and medium PA groups,

managers high in PA performed better on an interpersonal task (leaderless group discussion), and received higher ratings of managerial potential. In addition, they were more likely to request information and made more accurate decisions on an in-box exercise. They were also more aware of situational contingencies. The authors concluded that PA has an energizing function which leads to more effective managerial behavior.

Walumbwa and Schaubroeck (2009) examined the relationship between managers' personality traits and workers' ratings of supervisors' ethical leadership, and psychological safety, which refers to the perception that it is safe for workers to engage in interpersonal risk-taking and is positively related with workers' exercise of voice. They found that managers' levels of agreeableness and conscientiousness were positively related to subordinates perceptions of ethical leadership, which was directly related to perceptions of psychological safety. In addition, perceptions of ethical leadership fully mediated the relationship between managers' agreeableness and workers' psychological safety. However, perceptions of ethical leadership only partially mediated the relationship between managers' conscientiousness and workers' psychological safety.

Only one study has examined the relationship between manager's personality and safety outcomes. Thoms and Venkataraman (2002) hypothesized that four of the Big Five factors would be related to accident and injury rates. They reasoned that managers' conscientiousness, extraversion, and agreeableness would be negatively related to accident and injury rates. Conscientious managers would be likely to attend

to details, limit unsafe working conditions, anticipate potential accidents, and consistently review safety issues. Extraverted managers would tend to be outgoing and energetic, and thus, make more time to visit work sites and talk to their subordinates about safety problems and concerns. Agreeable managers would be more likely to interact with, and care about their subordinates, and thus, pay more attention to safety. They also hypothesized that managers high in neuroticism would be more concerned about meeting their production goals and would tend to push their workers to meet these goals. This should lead to higher accident and injury rates. They found that managers' neuroticism was positively related to injury rates, while managers' conscientiousness and extraversion were negatively related to accident rates.

In summary, while early research failed to discover a consistent profile of personality traits which characterize effective leaders, more recent research has shown the utility of managerial traits in predicting outcomes at the organizational-, group-, and individual-level. Taking an interactional perspective George (1991, 1992) posits that traits interact with the situation to produce states which lead to behaviors. Recent research has focused on the effects of manager's level of PA/NA and Big Five personality factors in predicting a variety of outcomes. The only study of safety outcomes found significant correlations between managers' conscientiousness, extraversion, and neuroticism, and accident/injury rates. However, these studies focused on factor-level personality predictors. In the next section I will propose trait-level predictors at the supervisor-level which should be related to the development of a positive workgroup safety climate.

Manager Traits and Safety Climate

For supervisors it is hypothesized that personality will be directly related to the development of a positive workgroup safety climate (see Figure 1). Safety climate refers to perceptions of the relative importance of production versus safety in workgroup members. Workgroup supervisors play the most important role in the development of safety climate through monitoring and feedback (Zohar & Luria, 2003). In addition, several studies suggest that leadership styles which convey concern for the well-being of subordinates are related to the development of a positive safety climate (Barling, Loughlin, & Kelloway, 2002; Kelloway, Mullen, & Francis, 2006; Zohar, 2003b) and a variety of safety outcomes (Hofmann & Morgeson, 1999; Hofmann, Morgeson, & Gerras, 2003).

Although there are no previous studies of the relationship between Big Five traits in supervisors and unit-level safety climate, a few studies show the importance of trust in supervisors. Conchie and Burns (2009) reported that trust in supervisors as an information source about safety was based on demonstrations of caring by the supervisor. Likewise, Conchie and Donald (2009) showed that safety-specific trust moderated the relationship between leadership style and safety citizenship behaviors. Finally, Luria (2010) showed that trust in management was positively related to safety climate strength and level. These studies suggest that Big Five personality traits which facilitate positive interpersonal relationships and trust between supervisors and workers should be related to the development safety climate in workgroups.

Specifically, traits of extraversion and agreeableness are likely to lead to behaviors which would facilitate interpersonal relationships and trust between supervisors and workers. An examination of the Big Five traits (See Table 4 for descriptions of the traits from McCrae and Costa, 1992) suggest that three Big Five traits in supervisors would be likely to affect the development of safety climate. Two traits of extraversion (cheerfulness and friendliness) and a single trait of agreeableness (altruism) are relevant here. People high in friendliness tend to be friendly, sociable, cheerful, affectionate, and outgoing. People high in cheerfulness tend to be enthusiastic, praising, humorous, spontaneous, and optimistic. Finally, people high on altruism tend to be warm, soft-hearted, gentle, generous, kind, not selfish, and tolerant. Supervisors high in these traits should be skilled at initiating and maintaining social relationships, conveying the importance of worker's safety and well-being, and providing feedback to their subordinates that will improve their safety performance and foster a positive safety climate in their workgroups.

It could be argued that other traits of extraversion and agreeableness might also affect the formation of positive interpersonal relationships between supervisors and workers, as well as the formation of a positive unit-level safety climate. For example, people high on the extraversion trait of gregariousness tend to be sociable, outgoing pleasure-seeking, spontaneous, and talkative. While it would be expected that people high on gregariousness would be skilled at forming interpersonal relationships, the pleasure-seeking and spontaneous aspects of this trait suggest less concern for others than the self, while safety climate perceptions of workers is related to the supervisor's

concern for workers' safety. Similarly, the extraversion traits of assertiveness, activity, and excitement seeking reflect a self- rather than an other-focus.

Most of the agreeableness traits do not appear to be related to the formation of interpersonal relationships between supervisors and subordinates (e.g. trust, straightforwardness, compliance, modesty). Individuals high in tender-mindedness share most of the characteristics of those high in altruism, however, the latter is also characterized by unselfishness which could lead a supervisor to focus more on the safety of workers than receiving rewards for more production.

Proactive Personality

According to Bateman and Crant (1993) proactive behavior is related to people's needs to manipulate and control the environment, which are known to vary across individuals. This suggests the presence of a latent trait they call proactive personality. People high in proactive personality tend to be unconstrained by situational forces, they seek out opportunities for change, show initiative and take action, and persevere until change occurs. Bateman and Crant develop the 17-item Proactive Personality Scale to measure what they assumed was a unidimensional trait. The final scale loaded on a single factor (in three independent samples) and showed adequate reliability. Both internal consistency (α = .89) and test-retest (r = .72 over 3 months) reliabilities were demonstrated.

Associations between proactive personality and a number of other traits have been documented. Proactive personality is positively related to conscientiousness (rs = .15 - .43) and extraversion (rs = .20 - .35) and openness to experience (r = .37;

Bateman & Crant, 1993; Crant, 1995; Major, Turner, & Fletcher, 2006). Major et al. examined the relationships between Big Five traits, proactive personality, motivation to learn, and developmental activity. They found that nine traits of the Big Five personality factors (vulnerability, assertiveness, activity, actions, ideas, values, altruism, dutifulness, and achievement striving) accounted for 26% of the variance in proactive personality scores. They also found that proactive personality accounted for additional variance over extraversion, conscientiousness, and openness to experience in predicting motivation to learn.

In addition, Bateman and Crant (1993) reported that proactive personality is related to the need for achievement (r = .45) and the need for dominance (r = .43). Significant associations between proactive personality and a variety of behaviors and outcomes have also been reported. These include extracurricular activities, personal achievements, and peer ratings of transformational leadership (Bateman & Crant), job performance (Crant, 1995), and relationship building and role clarity (Finkelstein, Kulas, & Dages, 2003). Proactive personality has also accounted for incremental variance in hierarchical regressions predicting charismatic leadership (Crant & Bateman, 2000) and career success in real estate agents (Siebert, Crant, & Kraimer, 1999).

A few studies have tested more complex models of the correlates and consequences of proactive personality. Parker and Sprigg (1999) examined the relationship between job demands, job control and strain (Karasek, 1999) in employees who scored high and low on the Proactive Personality Scale. Karasek's

model predicts that high demand jobs will cause less strain when employees have a high level of control over their work. However, Parker and Sprigg found that job control reduced strain in high demand jobs only for employees with proactive personalities. Job control did not ameliorate strain from high job demands in passive employees. Siebert, Kraimer, & Crant (2001) tested a structural model in which the effect of proactive personality on objective and subjective measures of career success was fully mediated by proactive behaviors/cognitions (voice, innovation, political knowledge, and career initiative). The model fit the data well and demonstrated that proactive personality leads to proactive behaviors at work which are related to career success. Finally, Harvey, Blouin, and Stout (2006) tested competing models of proactive personality as a moderator of the relationship between interpersonal conflict at work and individual outcomes. In their buffering model–based on the general stress buffering hypothesis (cf. Jex & Beehr, 1991) – proactive personality would be expected to reduce the negative effects of interpersonal conflict. In contrast, the accentuation model–based on the work of De Dreu & Weingart (2003) and Amason (1996) – predicts that proactive personality would exacerbate the negative effects of interpersonal conflict at work. In this model, proactive people will tend to experience more frustration because of the often illogical and uncontrollable nature of interpersonal conflict. Harvey, et al. found support for the accentuation model. Proactive people reported more burnout at work and school, less job satisfaction, and lower grades than their passive counterparts.

In summary, proactive personality is a compound personality trait that is only partially related to the Big Five factors of extraversion, conscientiousness, and openness to experience. Proactive personality is predictive of a number of general behaviors (e.g. identifying opportunities, challenging the status quo, creating favorable conditions) and context-specific behaviors (e.g. socialization, feedback seeking, issue selling, innovation), and individual outcomes (e.g. job performance, career success, feelings of personal control, role clarity). However, I am unaware of any studies of the effects of managers' proactive personality on subordinates attitudes, cognitions, perceptions, behaviors, or work-related outcomes.

Considering the correlates of proactive personality and the consequences of proactive behaviors, it is likely that supervisors' proactive personality will be related to the development of a positive unit-level safety climate under certain conditions. Proactive personality is related to leadership styles and behaviors that are positively related to safety climate, such as transformational leadership (Bateman & Crant, 1993), charismatic leadership (Crant & Bateman, 2000), and relationship building (Finkelstein, Kulas, & Dages, 2003). Leadership style is related to safety climate (Barling, Loughlin, & Kelloway, 2002; Kelloway, Mullen, & Francis, 2006; Mullen & Kelloway, 2009), and supervisors with a transformational leadership style tend to foster a positive safety climate. Transformational leaders are able to convey the importance of safety to their subordinates, inspire and motivate their subordinates to work for the collective good, spur new ways of thinking to improve safety, and take an active interest in their subordinates' welfare and well-being. Therefore, if supervisors

with a proactive personality are more likely to have a transformational leadership style, they should also be more likely to foster a strong, positive safety climate in their work groups. However, the positive relationship between supervisors' proactive personality and safety climate should depend on supervisors' perceptions of organizational safety climate.

Supervisors' Proactive Personality and Organizational Safety Climate

The research shows that proactive personality leads to general and context specific behaviors that lead to career success (Siebert, Kraimer, & Crant, 2001). These behaviors include identifying opportunities for change, showing initiative and taking action, and persevering until change occurs. Zohar and Luria (2003) showed that supervisors engage in sense-making to determine the relative value of safety vs. production at work. Therefore, the focus of proactive behaviors should also be related to what is valued at work, in other words, organizational climate. If the organizational climate places a positive value on safety at work, proactive personality in supervisors should lead to behaviors aimed at improving safety. However, if the organizational climate places a higher value on production relative to safety, proactive personality in supervisors should lead to efforts to improve production. This suggests that supervisors' perceptions of organizational safety climate should moderate the relationship between supervisors' proactive personality and unit-level safety climate perceptions in workers. Supervisors high in proactive personality will create a more positive unit safety climate in the presence of a positive organizational safety climate, than those operating in a negative organizational safety climate. Finally, in the next

section I will discuss workers' personality traits that should be related to safety motivation, and safety behaviors.

Worker's Personality Traits, Safety Motivation, and Safety Behaviors

There is some evidence suggesting Big Five personality traits in workers should relate to safety motivation and safety behaviors. As Barrick and Mount (1995) noted, the conscientiousness and its traits are better predictors of "will do" behaviors than "can do" behaviors. Similarly, Barrick, Stewart, and Piotrowski (2002) found that motivation mediates the relationship between Big Five personality factors and job performance. This suggests that conscientiousness traits should be related to safety motivation. Regarding work-related behaviors, Dudley et al. (2006) reported that dependability is related to job dedication and counterproductive work behaviors. Similarly, Hough (1992) reported that dependability predicted law abiding behaviors (following rules), and Moon (2001) found that dutifulness related to acting for the benefit of the organization. However, I am unaware of any studies that have examined the relationship between conscientiousness traits and safety outcomes.

Previous studies of the Big Five conscientiousness factor and safety outcomes have shown small (Arthur & Graziano, 1996; Cellar, Nelson, & York, 2001; Christian et al., 2009) and inconsistent relationships (Clarke & Robertson, 2005, 2008; Lardent, 1991; Salgado, 1992). Referring back to the bandwidth-fidelity dilemma, it is possible that specific trait-level variance will show stronger relations with safety outcomes than the conscientiousness factor, and increase our understanding of the conflicting results. A number of studies have shown that traits of the Big Five are related to both broad

and narrowly defined criteria across situations, and can account for incremental variance over their respective factors (Barrick & Mount, 1995; Dudley, et al., 2006; Hough, 1992). Similarly, it has been suggested that choosing trait-level predictors on a theoretical or rational basis should result in stronger relationships with criteria (Barrick & Mount, 1995; Paunonen & Ashton, 2001a).

On rational grounds two traits of conscientious seem most relevant to safety outcomes, order and cautiousness. People high on order have been described as organized, careful, methodical and thorough. Similarly, people high on cautiousness are viewed as thorough, careful, patient, and not easily distracted. Workers high on these traits are likely to comply with safety rules and procedures, which often requires extra time and effort. In addition, they are likely to be aware of potential hazards and take action to remove hazards from the workplace. While it cold be argued that all of the traits of conscientiousness should be related to safety, the foregoing suggests that the conscientiousness traits of order and cautiousness should be related to safety motivation and safety compliance behaviors (performing prescribed safety behaviors).

The Big Five agreeableness factor has shown small to moderate negative relationships to accidents (Cellar, Nelson, & York, 2001; Clarke & Robertson, 2005, 2008). Similarly, Ashton (1998) found that agreeableness is negatively related to counterproductive work behaviors. However, as with conscientiousness, agreeableness traits may show stronger predictor-criterion relationships than the agreeableness factor. I am aware of only one study that examined the relationship between agreeableness traits and safety outcomes. Chen (2009) found that altruism was negatively related to

risk-taking attitudes among young Taiwanese motorcyclists. Likewise, three other studies have demonstrated the importance of workers' social interactions on safety outcomes. Tucker et al. (2008) showed that perceived co-workers' support for safety fully mediated the relationship between perceived organizational support for safety and the exercise of workers' safety voice. Luria (2008) showed that both leadership style and workgroup social cohesion influenced safety climate strength. Finally, Zohar and Tenne-Gazit (2008) showed that the relationship between transformational leadership and safety climate strength was partially mediated by workgroup safety communications and friendships.

Rationally, two traits of agreeableness seem relevant to safety outcomes, altruism and trust. People high on altruism are warm, kind, tolerant, and soft-hearted, while people high on trust are forgiving, trusting, open, and soft-hearted. Altruism reflects warm and kind feelings towards others which should provide motivation to act for the benefit of others. Similarly, workers scoring high on trust should be amiable work-team members who develop good relationships with co-workers, again enhancing to motivation to act for the benefit of others. On the other hand, while agreeableness traits of straightforwardness, compliance, and modesty would facilitate getting along with others, they do not obviously relate to safety motivation. The foregoing suggests that the agreeableness traits of altruism and trust should be related to safety motivation and safety participation (discretionary) behaviors.

This chapter has reviewed a number of individual differences related to accidents including locus of control, impulsivity trait affect cognitive failure, and Big

Five factors. A review of the bandwidth-fidelity dilemma and a number of recent studies suggest utility in using Big Five traits as predictors at both the supervisor and worker levels. In addition, arguments were made suggesting proactive personality and Big Five traits in managers should be related to safety climate in their workgroups. Finally, rational arguments for the relationship between Big Five traits in workers and safety motivation were presented. In the next chapter I will review the research on safety outcomes including safety motivation, safety knowledge, two types of safety behaviors, and accidents/injuries.

Chapter IV

Safety Outcomes

Given the high cost of occupational accidents and injuries, and the efforts by organizations to reduce these costs, many safety researchers logically focus on the reduction of accidents and injuries (cf. Clarke, 2006a). However, accidents and injuries present problems as outcome measures for researchers investigating organizational influences on occupational safety. First, accidents and injuries occur infrequently and are not normally distributed, making statistical prediction difficult. Low base rate count data like accidents and injuries are often over-dispersed (i.e. the mean and variance of the distribution are unequal) necessitating the use of alternatives to ordinary least squares regression, for example negative binomial regression (Abdel-Aty & Radwan, 2000; Hofmann & Mark, 2006). Second, accidents and injuries are considered a lagging indicator of the state of safety as they only occur when there is a system failure, and do not provide any information on safety conditions across worksites or risks to workers (Seo, et al., 2004). Finally, the correlation between organizational safety variables such as safety climate and accidents tends to be small, although in the predicted direction (Clarke, 2006a). One reason for these weak relationships is that organizational factors are distal predictors of accidents and injuries (Neil & Griffin, 2004; Zohar, 2003). Researchers have responded to these problems by measuring additional outcome variables such as microaccidents (Zohar, 2000) and near misses (Seo, et al., 2004). Several studies have also examined the perceptual, cognitive, social, and behavioral antecedents of accidents and injuries as

outcome variables. For example, Clarke and Ward (2006) examined the relative importance of manager-worker value congruence and behavioral modeling on workers safety behaviors. Hofmann, Morgeson, & Gerras (2003) showed that safety climate moderates the relationship between leader-member exchange and safety citizenship role definitions. Finally, Truxillo, Bauer, Reiser, & Bertolino (2006) showed that safety motivation mediated the relationship between safety climate and safety attitudes.

Neil and Griffin (2004) present a mediated model that describes the mechanisms through which organizational and individual variables affect safety outcomes (see Figure 3 below). In this model, work environment antecedents like safety climate and organizational factors (e.g. supervision, work design) combine with individual antecedents like attitudes and personality traits to affect safety knowledge and safety motivation at the individual level. Safety knowledge and motivation in turn affect safety behaviors, which in turn affect safety outcomes like accidents, injuries, and near misses. Building on the concepts of task and contextual behaviors (Borman & Motowidlo, 1993) Griffin and Neal (2000) describe two types of safety behaviors. *Safety compliance* behaviors refer to "core safety activities that need to be carried out by individuals to maintain workplace safety" (p. 349). Examples of safety compliance behaviors include wearing required personal protective equipment or testing the air quality of underground vaults before entering. As such, safety compliance behaviors are similar to Borman and Motowidlo's concept of task performance. *Safety participation* refer to "behaviors such as participating in voluntary safety activities or attending safety meetings" (p. 349). In other words, safety participation behaviors

are discretionary behaviors by workers that are specifically related to safety similar to Borman and Motowidlo's concept of contextual performance. Safety outcomes could refer to accidents, injuries, microaccidents, and near misses; these tend to be measured either objectively (e.g. OSHA recordable incidents, company records) or by self-report. The model improves our understanding of the mechanisms through which distal factors affect accidents and injuries, while also suggesting additional outcome measures such as safety knowledge, safety motivation, and safety behaviors. This review of the safety outcome literature will begin with a description of the model by Griffin, Neal, and their colleagues, followed by other studies which examine parts of the model.

A paper by Griffin and Neal (2000) describes two studies testing their model. In their first study they examined the relationship between safety climate, safety knowledge, and both types of safety behaviors, compliance and participation. They found that safety knowledge partially mediated the relationship between safety climate and safety compliance behaviors, but not participation behaviors. In other words, safety knowledge was not significantly associated with safety participation behaviors, but safety climate had a strong effect. In addition, the two types of safety behaviors were weakly related. Figure 4 illustrates the path model from Study 1 (Griffin & Neal, 2000).

Their second study examined the relationships between safety climate, safety knowledge, two types of safety motivation (compliance and participation), and the two

types of safety behaviors. In this study, the relationship between safety climate and safety behaviors was fully mediated by safety knowledge and safety motivation. As in study 1, the two types of safety behaviors were weakly correlated. However, unlike study 1, safety knowledge was strongly related to both types of safety behaviors. Safety climate showed moderate positive relationships with both types of safety motivation, but a much stronger relationship with safety knowledge. In addition, safety motivation was weakly related to safety knowledge. The relationship between safety participation motivation and safety knowledge was small (r = .15); safety compliance motivation was not significantly related to safety knowledge. However, the two types of safety motivation were strongly correlated (r = .75). Participation motivation showed a strong positive relationship with safety participation behaviors, but there was no significant relationship with safety compliance behaviors. Of even more interest, compliance motivation showed a weak and positive relationship with safety compliance behaviors and a strong negative relationship with safety participation behaviors. The authors suggest this might be explained by resource allocation models (Kanfer & Ackerman, 1989) which posit that task motivation can lead to decreases in contextual behaviors. Figure 5 shows the path model from Study 2 (Griffin & Neal, 2000).

Neal, Griffin, and Hart (2000) examined the relationship between organizational climate, safety climate, safety knowledge and motivation, and safety behaviors. They found that the safety climate fully mediated the relationships between organizational climate and other variables. In addition, safety knowledge and safety

motivation fully mediated the relationship between safety climate and safety compliance behaviors, and partially mediated the relationship between safety climate and safety participation behaviors. Safety climate showed strong positive relationships with both safety knowledge and safety motivation. In turn, safety knowledge showed moderate positive relationships with safety compliance and participation behaviors. Likewise, safety motivation showed moderate to strong relationships with both types of safety behaviors. Figure 6 depicts the final path model.

While all three of these studies provide support for the model, they are also cross-sectional in design and do not rule out reverse causation as an explanation for the results. Reverse causation suggests that accident involvement could lead to decreases in safety climate perceptions for the worker in question. To rule out reverse causation Neal and Griffin (2006) conducted a longitudinal, multilevel test of their model. They found that group safety climate predicted individual safety motivation which in turn predicted individual safety participation behaviors. However, safety motivation was not related to safety compliance behaviors, as had been reported previously by Probst and Brubaker (2001). The authors attributed the discrepant results to different measures of safety motivation. In addition, individual self-reported safety behaviors, when aggregated to the group level, predicted group accident rates. Finally, they reported a reciprocal relationship between safety motivation and safety participation behaviors. The authors hypothesized that the performance of safety participation behaviors was reinforced, which increased safety motivation and led to more safety participation behaviors. This study is important because it establishes the

direction of causality specified in the model, rules out reverse causation as an alternative explanation, demonstrates the influence of group-level variables on individual behavior, and shows the utility of examining accident rates by workgroup.

Safety Climate

A large number of studies have examined different models which include some of the variables discussed by Griffin and Neal. For example, several researchers have examined the consequences of safety climate. This research is presented in detail in Chapter II, so I will only summarize the literature here. The inverse relationship between a positive safety climate and accidents/injuries is well documented (e.g. Wallace et al., 2006; Zohar, 2000) but weak. Meta-analyses suggest a small and unreliable relationship between safety climate and accidents/injuries; in longitudinal studies safety climate also predicts accidents/injuries (Clarke, 2006a). Safety climate is also related to a number of safety-related behaviors including use of personal protective equipment (McGovern et al., 2000), self-reported at-risk behaviors (Watson et al., 2005), unsafe behaviors (Clarke, 2006b), and safety compliance and safety participation behaviors (Clarke, 2006a). Finally, as discussed previously, safety climate predicts safety knowledge and safety motivation (Neal, et al., 2000; Neal & Griffin, 2006). I will now turn my attention to other variables in the model.

Safety Knowledge

Safety knowledge is important because information about occupational safety makes it more likely that workers will successfully cope with potentially dangerous situations (Westaby and Lee, 2003). Safety training is based on the assumption that

providing knowledge will reduce accidents/injuries (Reber & Wallin, 1984); managers in high reliability process industries make the same assumption (Hofmann, Jacobs, & Landy, 1995). Safety knowledge is positively related to safety communication (Hofmann & Morgeson, 1999), safety behaviors and tenure (Westaby & Lee, 2003), and improves with training (Wells, Stokols, McMahan, & Clitheroe, 1997). Finally, safety knowledge fully mediated the relationship between safety climate and safety behaviors (Larsson, Pousette, & Torner, 2008).

Safety Motivation

There are two main theoretical perspectives which predict safety motivation, social exchange and expectancy-valence theories. Social exchange theory (Blau, 1964) suggests that when employees perceive the organization is genuinely concerned for their well-being, the norm of reciprocity (Gouldner, 1960) is invoked and employees will feel an obligation to reciprocate with beneficial work behaviors. Employees may reciprocate by performing their core work tasks at a high level or by performing contextual or citizenship behaviors (Tsui, Pearce, Porter, & Tripoli, 1997). For example, Gyekye & Salminen (2005) found that soldier's perceptions of organizational commitment to safety were positively related to organizational citizenship behaviors. Similarly, Hofmann and Morgeson (1999) reported that perceived organizational support and high-quality LMX relationships were related to workgroup supervisors' levels of safety communication and safety commitment (motivation). In addition, Hofmann, Morgeson, and Gerras (2003) found that safety climate moderated the relationship between LMX and safety citizenship role

definitions, and ultimately safety citizenship behaviors. They concluded that safety climate defines behaviors that are valued by the leader and the organization, and high-quality LMX relationships lead to employee reciprocity. These studies suggest that positive social exchange relationships can be an important factor in generating safety motivation.

Expectancy-valence theory (Van Eerde & Thierry, 1996) predicts employees will be motivated to follow prescribed safety procedures and participate in discretionary safety activities if they believe doing so will lead to valued outcomes. Few studies have explicitly examined expectancy-valence theory to explain safety motivation. Truxillo, Bauier, Reiser, & Bertolino (2006) developed the VIES measure of safety motivation, which consists of three subscales for valence, instrumentality, and expectancy. They found that safety motivation fully mediated the relationship between safety culture perceptions and two types of safety attitudes: the likelihood of supporting the safety program and behavioral intentions to act safely. In addition, safety motivation partially mediated the relationship between agreeableness and support for the safety program, and partially mediated the relationship between the safety sensitivity of the job and behavioral intentions to act safely. In a follow-up study, Truxillo, Buck, McCune, Bauer, Hammer, & Bertolino (2007) reported that VIES safety motivation scores had moderate to strong relationships with safety compliance behaviors and safety participation behaviors.

An examination of the safety motivation items from Griffin and Neal (2000) and Griffin, Neal, and Hart (2000) suggests these safety motivation scales are more

related to expectancy-valence theory than social exchange theory. The safety motivation scale items from these two studies are presented in Table 5 below. Only two of the 15 items refer to other people (two factor version #s 8 and 11), and none refer to managers. On the other hand, several items seem to be tapping into the value individuals place on safety. For example, 'I feel that it is important to maintain safety at all times' (single factor version #3) and 'I believe that it is worthwhile to volunteer for safety related tasks' (two factor version #9). Several items seem to be assessing the expectation that safety-related behaviors will lead to desired outcomes, although these outcomes are not made explicit. For example 'I feel that adhering to tagout/lockout procedures is worthwhile' (two factor version #1) and 'I believe that it is worthwhile to volunteer for safety related tasks' (two factor version #10). Conversely, none of the items seem to be assessing instrumentality or the belief that one can perform the necessary behaviors to obtain the desired outcome. Therefore, while Griffin, Neal, and colleagues do not specifically refer to expectancy-valence theory, their safety motivation measures appear to tap into the value workers place on safety outcomes and the expectations that safety-related behaviors will lead to desired outcomes. Two intervention studies also offer support for an expectancy-valence approach to safety motivation.

Cooper, Phillips, Sutherland, & Makin (1994) describe a goal setting and feedback intervention to reduce accident rates. Goal setting affects performance by directing attention and behaviors, mobilizing effort, increasing persistence, and motivating the search for performance strategies (Locke & Latham, 2002). In terms of

expectancy-valence theory, goal setting highlights the valence of goal achievement, and in conjunction with feedback, strengthens the perception that behaviors can be performed which will lead to valued outcomes. The authors found that goal setting and feedback increased safety behaviors and led to reduced accident rates. In another interesting study, Lingard (2002) found that first aid training affected the safety motivation and safety behaviors of Australian construction workers. Following first aid training workers were less willing to accept current levels of safety on the job and reported increase perceptions of risk. They also reported more awareness of the importance of safety behaviors. While Lingard did not specifically relate these findings to expectancy-valence theory her results suggest that following first aid training the workers placed a greater value on behaving safely–possibly in reaction to increased perceptions of risk–and believed that they could improve the levels of safety on the worksite. In summary, these studies suggest that safety motivation, whether stemming from social exchange relationships or expectancy-valence cognitions (or a combination of both), is related to safety behaviors as posited by Griffin & Neal (2004).

However, several other studies of safety motivation have taken a less theoretical approach. For example, Newman, Griffin, and Mason (2008) studied factors related to work-related driving accidents. They found that driver's attitudes towards rule violations (e.g. speeding) and safe driving self-efficacy were both positively related to safety motivation, which predicted self-reported driving accidents. Maierhofer, Griffin, & Sheehan (2000) examined how managers' values for safety and

time urgency (production pressure) were conveyed to subordinates, and the effect of these values and behavioral modeling on behavior. Interestingly, while subordinates tended to show value congruence with their managers, only time urgency values were related (inversely) to safety behaviors. Modeling of safe behaviors by managers was also positively related to subordinate safe behavior. Finally, Mullen (2004) conducted a qualitative study of the factors affecting safety behaviors at work. She describes several organizational and social factors that are likely to affect safety motivation. Organizational factors included role overload which leads to a focus on performance over safety and socialization of employees to violate safety rules. Social factors affecting safety behaviors included coercive pressure to violate safety rules from co-workers and supervisors, negative attitudes towards safety, the need to maintain an image as competent or tough and avoiding teasing and harassment from co-workers for behaving safely. This study, along with Maierhofer, et al. show how behavioral constructs such as modeling, reinforcement, and punishment can be applied to safety motivation.

In summary, safety motivation has been studied from different theoretical perspectives and measured with different instruments. As predicted by Griffin and Neal (2004) safety motivation acts as a mediator between safety climate and safety behaviors. A variety of interventions affect safety motivation including supervisor modeling, goal setting and feedback, reinforcing and aversive social relationships/interactions, risk perceptions and safety sensitivity, and expected outcomes.

Safety Behaviors

By some estimates 80-90% of all industrial accidents can be attributed to the actions of individuals (Reason, 1990), however, there are a number of influences on workers' behavior. Reason suggests that accidents are often caused by unintentional errors by the involved worker or co-workers. Failure to comply with safety procedures (poor safety compliance) and a lack of effort to improve safety (poor safety participation) can lead to pre-existing hazards (e.g., poor housekeeping) that increase vulnerability to accidents for the whole work group. As the proportion of unsafe employees in a group increases, hazards will tend to accumulate over time, thereby increasing the probability of accidents for the group as a whole. This is not to suggest that individuals bear the sole, or even primary, responsibility for unintentional errors that result in accumulating hazards and accidents. Several researchers have shown that organizational safety policies and procedures, organizational safety climate, supervisors' safety practices, and unit-level safety climate have direct and indirect effects on individual workers' safety behaviors (e.g. Neal & Griffin, 2004; Zohar, 2003a).

Safety behavior has been firmly established as the most proximal antecedent of safety outcomes like accidents/injuries (Griffin & Neal, 2000; Griffin, Neal, & Hart, 2000; Johnson, 2007; Neal & Griffin, 2006). Studies supporting the mediated relationships in the Griffin and Neal model have been presented above. Therefore, in this section I will discuss research related to supervisory interactions and intra-individual influences on safety behavior.

As the safety climate studies presented in Chapter II and summarized earlier clearly show, supervisors have a strong influence on the safety-related behaviors of their subordinates. Two others studies reinforce the importance of supervisor interactions and feedback on safety performance. Austin, Kessler, Riccobono, and Bailey (1996) described an intervention in which roofers earned time off with pay when they reached or surpassed 80% compliance with a safety checklist. Baseline levels of safety compliance averaged 53% and increased to 93% following the intervention. Similarly, Luria, Zohar, and Erev (2008) reported that the physical layout of the work area had a direct effect on the frequency of supervisor-subordinate interactions. When employees were clearly visible to their supervisors there were more supervisor-employee interactions and more safe behaviors than in situations where employees were less visible. These results are consistent with previous studies (Zohar, 2002; Zohar & Luria, 2003) showing the importance of supervisor-employee interactions in promoting safety behaviors.

A number of studies have documented the effect of intra-individual influences such as reactions to work stress and boredom, and personality traits, on safety behaviors. This research has been reviewed in chapter III so I will only summarize the literature here. In general, these factors are assumed to cause distraction and lapses of attention, which lead to unsafe behaviors. For example, Rundmo (1992) found that work stress was related to human errors and injuries. In addition, cognitive failures are related to unsafe behaviors and accidents (Larson et al., 1997; Wallace and Vodanovich, 2003a). Similarly, Game (2007) found that the ability to cope with

boredom was related to employees' well-being and compliance with safety rules. Relative to low boredom-copers, high boredom-copers tended to cope with boredom at work in ways that were more functional for themselves and the organization. For example, they would try to develop new strategies to perform job tasks better, while low boredom-copers were more likely to seek excitement and violate rules. Finally, personality traits are also related to safety behaviors. For example, some studies have reported that conscientiousness and agreeableness are related to safety behaviors and accidents (Arthur & Graziano, 1996; Cellar et al., 2001; Clarke & Robertson, 2005, 2008; Wallace & Chen, 2006). In addition, extraversion and neuroticism are related to unsafe behaviors and accidents (Hansen, 1988; Lajunen, 2001; Ozkan & Lajunen, 2007). However, not all researchers have been able to demonstrate these relationships (cf. Salgado, 2002), and the effect sizes are typically small.

In summary, unsafe behaviors are direct antecedents of accidents and injuries, but a number of organizational, social, and intra-personal factors affect behaviors at work. Interactions with supervisors and co-workers may be the most important influences. When supervisors convey the importance of safety to their workers (a strong, positive safety climate) through monitoring, feedback, and coaching, safety behaviors increase and accidents/injuries decrease. In addition, intra-individual variables can cause workers to become distracted, suffer lapses of attention, or seek excitement in response to boredom, all of which can lead to unsafe behaviors and accidents/injuries.

CHAPTER V

Hypotheses

The primary aim of this study was to test the relationships in a proposed model relating managers' personality to safety in the workplace. This study expands our knowledge of workplace safety by incorporating the effects of supervisors' personality on the development of safety climate. In particular, this is the first study, to my knowledge, that examines the effects of supervisors' proactive personality and Big Five trait-level variables on the development of safety climate in workgroups. In addition, the effect of supervisors' proactive personality on workers' perceptions of unit-level safety climate should be moderated by supervisors' perceptions of organizational safety climate.

This study also expands our knowledge by investigating the effect of workers' trait-level Big Five personality variables on workers' safety motivation and two types of safety behaviors, which to my knowledge has not been investigated. Specifically, I posit that workers' trait-level personality variables will be directly related to safety motivation and indirectly related to both types of safety behaviors.

Third, this study seeks to gather further evidence on the validity of the VIES measure of safety motivation. Specifically, this study evaluated the validity of the VIES within the Neal and Griffin (2004) framework (see Figure 3) on a sample of construction and maintenance workers. This allowed for a confirmatory factor analysis with a sample of construction and maintenance workers employed full-time. In

addition, this study tested the cross-level effects of workgroup safety climate on safety motivation as assessed by the VIES.

Finally, this study provided a partial replication of the Neal and Griffin mediated model. While the model has received good empirical support, some studies have not supported full mediation (e.g. Griffin & Neal, 2000). The fully mediated model was evaluated against partially mediated models, which might suggest the need for model revision. Detailed evidence supporting each hypothesis (presented in the preceding chapters) is reviewed, and a detailed description of each hypothesis is reviewed below. The study model with hypotheses is illustrated in Figure 1.

Supervisor Personality

Proactive personality. In Zohar's (2003a) multilevel climate model supervisory safety practices have a direct effect on group-level safety climate and safety behaviors. As employees try to determine what behaviors are desirable and rewarded at work they focus on both organizational-level consequences (performance evaluations, pay raises, job transfers) and unit-level consequences stemming from their immediate supervisor's frequency and intensity of monitoring safety behaviors, and responding to safety issues. Proactive personality is related to leadership styles and behaviors that are positively related to safety climate, such as transformational leadership (Bateman & Crant, 1993), charismatic leadership (Crant & Bateman, 2000), and relationship building (Finkelstein, Kulas, & Dages, 2003). Leadership style is related to safety climate (Barling, Loughlin, & Kelloway, 2002; Kelloway, Mullen, & Francis, 2006), and supervisors with a transformational leadership style tend to foster

a positive safety climate. Transformational leaders are able to convey the importance of safety to their subordinates, inspire and motivate their subordinates to work for the collective good, spur new ways of thinking to improve safety, and take an active interest in their subordinates' welfare and well-being. Therefore, if supervisors with a proactive personality are more likely to have a transformational leadership style, they should also be more likely to foster a strong, positive safety climate in their work groups.

However, the relationship between proactive personality and workers' perceptions of safety climate should depend on supervisors' perceptions of the value the organization places on safety relative to production. In other words, the level (positive or negative) of the organizational safety climate. When the supervisors perceive that the organization values safety, proactive behaviors by supervisors are more likely to be directed to improving safety in their workgroups, and thus, lead to a more positive unit-level safety climate. On the other hand, if the supervisors perceive that the organization places more value on production, supervisors' proactive behaviors should be directed to increasing output in their workgroups, leading to a less positive safety climate. Figure 7 shows the expected moderation of the relationship between supervisors' proactive personality and unit-level safety climate.

Hypothesis 1: Supervisors' perception of organizational safety climate will moderate the relationship between supervisors' proactive personality and unit-level safety climate.

Agreeableness and extraversion traits. Workgroup supervisors play the most important role in the development of safety climate through monitoring and feedback (Zohar & Luria, 2003). In addition, several studies suggest that leadership styles which convey concern for the well-being of subordinates and foster trust in management are related to the development of a positive safety climate (Barling, Loughlin, & Kelloway, 2002; Conchie & Burns, 2009; Conchie & Donald, 2009; Kelloway, Mullen, & Francis, 2006; Luria, 2010; Mullen & Kelloway, 2009; Zohar, 2003b) and a variety of safety outcomes (Hofmann & Morgeson, 1999; Hofmann, Morgeson, & Gerras, 2003). Supervisors high on two extraversion traits (friendliness and cheerfulness) and one agreeableness trait (altruism) should be skilled at initiating and maintaining social relationships, fostering trust in management, conveying the importance of worker's safety and well-being, and providing safety-related feedback to their subordinates, all of which should foster a positive safety climate in their workgroups.

Since the relationship between supervisors Big Five traits and workgroup safety climate has not been studied, the traits of cheerfulness, friendliness, and altruism were chosen because they are likely to lead to behaviors which would facilitate interpersonal relationships and trust between supervisors and workers. However, I will measure all of the traits of extraversion and agreeableness and conduct exploratory tests of their relationships to workgroup safety climate.

Hypothesis 2: The extraversion traits of a) cheerfulness, and b) friendliness in supervisors will be positively related to the development of a positive workgroup-level

safety climate; c) The agreeableness trait of altruism in supervisors will be positively related to the development of a positive workgroup-level safety climate.

Research Question 1: What is the relationship between the traits of extraversion and agreeableness in supervisors and workgroup-level safety climate perceptions?

Worker Personality.

Conscientiousness traits. Several researchers have documented relationships between conscientious traits, work attitudes and work behaviors. Hough (1992) reported that dependability predicted law abiding behaviors (following rules), and Moon (2001) found that dutifulness related to acting for the benefit of the organization. In addition, Dudley et al. (2006) reported that dependability is related to job dedication and counterproductive work behaviors. However, none of these studies examined motivation as a mediator of the relationship between personality and work behaviors. Barrick and Mount (1995) noted conscientiousness and its traits are better predictors of "will do" behaviors than "can do" behaviors, and Christian, et al. (2009) found safety motivation fully mediated the relationship between conscientiousness and safety performance. Similarly, Barrick, Stewart, and Piotrowski (2002) found that motivation mediates the relationship between Big Five personality factors and job performance. These studies suggests that conscientiousness traits should affect safety behaviors through their effect on safety motivation.

On rational grounds two traits of conscientious seem most relevant to safety outcomes, order and cautiousness. People high on order have been described as

organized, careful, methodical and thorough. Similarly, people high on cautiousness are viewed as thorough, careful, patient, and not easily distracted. Workers high on these traits are likely to comply with safety rules and procedures, which often requires extra time and effort. In addition, they are likely to be aware of potential hazards and take action to remove hazards from the workplace. The foregoing suggests that the conscientiousness traits of order and cautiousness should be related to safety motivation and safety compliance behaviors (performing prescribed safety behaviors). However, I will measure all the traits of conscientiousness and conduct exploratory tests of their relationships with safety motivation and safety compliance behaviors.

Hypothesis 3: The conscientiousness traits of a) orderliness and b) cautiousness will be positively related to safety motivation in workers.

Research Question 2: What is the relationship between any of the traits of conscientiousness in workers and safety motivation?

Agreeableness traits. Ashton (1998) found that agreeableness is negatively related to counterproductive work behaviors. Similarly, Clarke and Robertson (2005; 2008) examined the relationships between Big Five personality factors and accident involvement. The best predictor of accident involvement in these two meta-analyses was low agreeableness. Estimated true score correlation coefficients between low agreeableness and accidents ranged from ρ = .26 - .44. More importantly, low agreeableness was the only Big Five factor determined to be valid and generalizable in both meta-analyses. Finally, Chen (2009) found that the trait of altruism was negatively related to risk-taking attitudes. It is expected that two traits of

agreeableness (altruism and trust) will be indirectly related to safety participation behavior through a positive affect on safety motivation (Barrick, et al., 2002). Safety participation behaviors are discretionary (contextual) safety-related behaviors, for example, volunteering for safety-related activities, or removing hazards in the workplace to prevent injuries to self or others.

Rationally, two traits of agreeableness seem relevant to safety outcomes, altruism and trust. People high on altruism are warm, kind, tolerant, and soft-hearted, while people high on trust are forgiving, trusting, open, and soft-hearted. Altruism reflects warm and kind feelings towards others which should provide motivation to act for the benefit of others. Similarly, workers scoring high on trust should be amiable work-team members who develop good relationships with co-workers, again enhancing the motivation to act for the benefit of others. The foregoing suggests that the agreeableness traits of altruism and trust should be related to safety motivation and safety participation (discretionary) behaviors. However, I will measure all the traits of agreeableness and conduct exploratory tests of their relationships with safety motivation and safety participation behaviors.

Hypothesis 4: The agreeableness traits of a) altruism and b) trust will be positively related to safety motivation in workers.

Research Question 3: What is the relationship between any of the traits of agreeableness in workers and safety motivation?

Replications

The final aims of this study involve replications of previous research. First, the positive relationship between safety climate and safety motivation has been modeled by Neal and Griffin (2004) and Zohar (2003a), and demonstrated by Neal, Griffin, and colleagues (Neal, et al., 2000; Neal & Griffin, 2006) will be replicated using hierarchical linear modeling.

Hypothesis 5: Workgroup-level safety climate will be positively related to safety motivation after controlling for the individual-level Big Five traits of altruism, trust, cautiousness, and orderliness.

Second, confirmatory factor analysis will replicate previous results showing the proposed three factor structure of the VIES (Truxillo, et al., 2006, 2007). The three factors represent valence, instrumentality, and expectancy as defined by expectancy-valence theory (cf. Van Eerde & Thierry, 1996). Finally, the fit of the fully mediated study model (see Figure 1) will be tested against other possible partially mediated models.

Chapter VI

Method

In this study three sources of data were gathered from municipal employees: self-report, supervisor-report, and archival data. Supervisors self-reported on proactive personality and Big Five traits. Supervisors also rated their subordinates' safety behaviors. Workgroup members self-reported on Big Five traits, safety motivation, safety behaviors, and accidents/injuries. Finally, archival data was collected on accidents/injuries for the organization, but not individual workgroup members because of confidentiality concerns. These data are compiled by risk managers and includes workers' injuries and accidents, including vehicle accidents.

A power analysis was conducted using a Java applet from Lenth (2009) to determine the size of the workgroup member sample needed to detect an effect. Zohar (2002) reported an average $\Delta R^2 = .26$ for two types of leadership styles (transformational and contingent reward) in predicting safety climate. While little work has documented the relationship between trait-level personality variables and motivation, two studies provided benchmarks for the effect size used in this power analysis. Barrick and Mount (1995) suggest that conscientiousness and its traits are better predictors of motivation than task skill. Their meta-analysis showed small to moderate effect sizes (ρ^2 =.07-.19) for conscientiousness and two of its traits (achievement and dependability) in predicting motivation. In addition, Dudley, et al. (2006) reported that conscientiousness traits showed incremental validity ($\Delta R^2 = .259$) over conscientiousness in predicting job dedication.

The current power analysis was conducted to determine the sample size needed to have an 80% chance of detecting an effect using multiple regression. Conservative effect size estimates were used. For Hypothesis 1 predicting the moderated effect of supervisors' proactive personality on group-level safety climate, and Hypothesis 2 predicting positive relationships between the three Big Five traits in supervisors, a predicted effect size of $\Delta R^2 = .26$ was entered. Given this estimate, a sample of 33 supervisors will be needed to obtain the desired power. For Hypotheses 3 and 4, job tenure was entered as a demographic control variable with a predicted effect size of $\Delta R^2 = .02$. Second, the four Big Five traits (altruism, trust, cautiousness, orderliness) were entered with a predicted effect size of $\Delta R^2 = .08$. Given these estimates of effect size, a sample size of 140 workgroup members would be needed to have an 80% chance of detecting an effect.

Participants. Construction/maintenance and other field workers, and supervisors from a moderately sized Western city municipal bureau in the United States participated in this study. Participants were sampled either with paper-and-pencil surveys in small groups, or with a web survey. Both surveys had identical content. Participants who completed the paper-and-pencil survey received a short verbal introduction to the survey and read an informed consent cover letter describing the survey. A total of the 178 paper-and-pencil surveys were distributed to workers and supervisors. Of these 131 usable surveys (74%) were returned. The remainder either did not complete the survey or were unable to be assigned to a workgroup. An examination of the organizational chart suggests that there were 213 workers and

supervisors who could have potentially completed the survey, thus, about 84% of the domain was sampled. Employees who took the web survey received an email from the Bureau administrator introducing the survey and asking for their participation. They also received an informed consent cover letter and clicked on a link to begin the survey. The web survey was part of a larger data collection and was sent to employees at other organizational sites who also had more computer access. An examination of the organizational chart suggested an additional 94 workers and supervisors who received the email about the survey that could be potential study participants. Of these, 43 returned usable electronic surveys (46%). The final sample (N = 174) consisted of 28 supervisors and 146 workers.

Participants in this study were divided into two groups. The first group consists of unit-level supervisors and "lead persons" (hereafter referred to as supervisors) who are in charge of work-groups performing construction and maintenance work for the municipality. The second group consists of the workers in each workgroup. A total of 28 workgroups were sampled. Workgroup sizes varied from three to 24 workers (mean = 5.21; SD = 4.20; n = 146) and one supervisor (n = 28). Sample demographics will be presented separately for supervisors and workers.

Supervisor sample. The average age of the sample was 46.96 years (SD = 7.38 years; n = 28) and was predominantly male (93%) and Caucasian (89.3%). African-Americans, Pacific Islanders, and "other" accounted for 3.6% each. Exactly half of supervisors reported some college or an associate's degree followed by 28.6% with a

high-school diploma, 17.9% with a bachelor's degree, and 3.6% with graduate degrees. Supervisors' average organizational tenure was 14.89 years (SD = 7.82 years).

Worker sample. The average age of the sample was 44.16 years (SD = 10.72 years; n = 146) and was predominantly male (91%) and Caucasian (81.5%). The second highest racial category was "other" with 11.6%. All other groups accounted for less than 3% each. More than half (52.1%) of workers reported some college or an associate's degree followed by 24.7% with a high-school diploma, 19.2% with a bachelor's degree. Graduate degrees and "some high school" accounted for less than 3% each. Workers' average organizational tenure was 9.66 years (SD = 7.37 years).

Measures

Supervisor surveys. Supervisors completed five measures of personality along with measures of organizational safety climate perceptions, safety behavior ratings of workers, and demographic items. *Proactive personality* was measured with a 10-item scale from Siebert, Crant, and Kraimer (1999; α = .87), which was derived from the original 17-item scale by Bateman and Crant (1993). Participants responded to each item on a 7-point Likert scale (1 = strongly disagree, 7 = strongly agree). Sample items include "I am constantly on the lookout for new ways to improve my life" and "I excel at identifying opportunities."

In addition, three Big Five trait-level variables were measured with items from the International Personality Item Pool (IPIP; Goldberg, 1999). Only the positively worded items were used for the trait-level scales in this study. Participants responded to all trait-level items on a 5-point Likert scale (1 = very inaccurate, 5 = very accurate).

Two traits of extraversion were measured. *Cheerfulness* (8 items; α = .86) corresponds to the positive emotions trait scale in the NEO-PIR (McCrae & Costa, 1992). Sample items include "I radiate joy" and "I look at the bright side of life." *Friendliness* (5 items; α = .88) corresponds to the warmth trait scale in the NEO-PIR (McCrae & Costa, 1992). Sample items include "I make friends easily" and "I feel comfortable around people." A single agreeableness trait, *Altruism* (5 items; α = .86) corresponds to the altruism trait scale in the NEO-PIR (McCrae & Costa, 1992). Sample items include "I anticipate the needs of others" and "I am concerned about others." Since trait-level personality variables have not been assessed as predictors of safety outcomes, all of the traits for extraversion and agreeableness will be measured and examined in an exploratory manner. However, only cheerfulness, friendliness, and altruism are hypothesized to effect the development of group-level safety climate.

The final personality measure was a 5-item measure of emotional stability from the IPIP (α = .77; Goldberg, 1999) which was used as a control variable. Only positive items were used and participants responded on the same 5-point Likert scale used for the facet measures. A sample item is "I feel comfortable with myself."

Organizational safety climate perceptions in supervisors were assessed by a 16-item scale from Zohar and Luria (2005; α = .92). A sample item is "Top management in this bureau reacts quickly to solve the problem when told about safety hazards." In addition, two items from the safety climate scale used by Dedobbeleer and Beland (1991) were adapted and appended to the Zohar and Luria scale. These items are "Top management believes workers' safety practices are important for the

management of this bureau" and "Supervisors and top management seem to care about workers' safety." Supervisors responded to the organizational safety climate items on a 5-point Likert scale (1 = completely disagree, 5 = completely agree). The internal consistency of the combined scale (α = .90) was slightly lower than that reported by Zohar and Luria (2005).

In addition, supervisors were asked to rate each of their workgroup members on two types of safety behaviors described by Neal and Griffin (2004). *Safety compliance behaviors* were measured with a three-item scale (α = .96) from Neal and Griffin (2006). A sample item is "The worker uses all necessary safety equipment to do his/her job." *Safety participation behaviors* were measured with a three-item scale (α = .94) from Griffin and Neal (2006). A sample item is "The worker promotes the safety program within the organization." Supervisors responded to the safety behavior items on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree). The wording of the items on the two scales was adapted from a self-report format to a rating of subordinates' safety behaviors.

While I am unaware of any studies which used supervisor ratings of subordinates' safety behaviors using the Neal and Griffin (2006) scales, there is along history of supervisors rating subordinates' behaviors (i.e. performance evaluations; Viswesvaran, 2001). Viswesvaran notes that supervisor ratings tend to correlate higher with organizational records than peer ratings, suggesting supervisor ratings are more accurate. Borman and Motowidlo (1993) recommend rating both task and contextual behaviors, which are reflected in the Neal and Griffin scales as safety compliance

behaviors (task behaviors) and safety performance behaviors (contextual behaviors), respectively. In addition, Motowidlo, Borman, and Schmit (1997) suggest that performance ratings should focus on homogenous sets of behaviors rather than results or outcomes which may be out of the workers' control. An examination of the Neal and Griffin items reveals such a focus on behaviors. Finally, two studies using supervisor ratings of subordinates' safety behaviors—using different scales—demonstrated adequate reliability (αs = .86 - .96; Burke, Sarpy, Tesluk, & Smith-Crowe, 2002; Wallace & Chen, 2006). The forgoing suggests that supervisor ratings of subordinates' safety behaviors using the Neal and Griffin (2006) items are likely to be reliable and valid. In the current study, while supervisors provided only 40 ratings of subordinates' (n = 146) safety behaviors, the reliability of the supervisor ratings was slightly higher than those of workers reporting on their own safety behaviors.

Finally, *age, gender,* and *organizational tenure* were collected as control variables as some previous research has documented relationships between these demographic variables and accidents/injuries (Liao, Arvey, Butler, & Nutting, 2001; Loughlin & Frone, 2004). In addition, while most studies do not report significant relationships between demographic variables and safety outcomes, Hansen (1988) recommends controlling for demographic variables, and these variables are also commonly used to control for extraneous variance in multiple regression analyses (e.g. Arthur, Barrett, & Alexander, 1991; Arthur & Graziano, 1996; Dahlen, Martin, Ragan, & Kuhlman, 2005; Hansen, 1989; Iveson & Erwin, 1997). Gender was coded 0 =

female, 1 = male, age and job tenure were recorded in months. Items for the supervisor survey are presented in Appendix A.

Worker survey. Workers responded to four trait-level personality scales from the IPIP (Goldberg, 1999), on a 5-point Likert scale (1 = very inaccurate, 5 = very accurate). Two traits of agreeableness were measured, *altruism* (α = .87; sample items presented above) and *trust* (6 items; α = .89). Sample items from the trust scale include "I trust others" and "I trust what people say." In addition, work group members completed two trait-level scales of conscientiousness. *Cautiousness* (3 items; α = .81) corresponds to the deliberation scale in the NEO-PIR (McCrae & Costa, 1992). Sample items include "I avoid mistakes" and "I choose my words with care." *Orderliness* (5 items; α = .83) corresponds to the order scale in the NEO-PIR (McCrae & Costa, 1992). Sample items include "I like to tidy up" and "I do things according to plan." Again, all of the traits for agreeableness and conscientiousness were measured and examined in an exploratory manner. However, only altruism, trust, cautiousness, and orderliness were hypothesized to effect workgroup members' safety motivation.

Workers also responded to scales measuring safety climate, safety motivation, and two types of safety behaviors on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree). *Safety climate* was measured with a 10 item scale (Zohar, 2000) and showed good reliability (α = .88). Sample items include "My direct supervisor discusses how to improve safety with us" and "My direct supervisor is strict about working safely when we are tired or stressed."

Safety motivation was measured with the 13-item VIES (Truxillo et al., 2006, 2007; α = .95). The VIES consists of three subscales, valence, instrumentality, and expectancy which can be scored separately or combined into a total score. The total score was used in this study since a confirmatory factor analysis suggested adequate fit for a single second-order factor model (χ^2 = 113.226, p < .05, CFI = .963, GFI = .898, RMSEA = .078). Model fit was improved slightly by allowing the error terms on three of the instrumentality items to covary. Sample items include "Job safety is important to me" (valence), "If I stick to safety rules I can avoid accidents" (instrumentality), and "I can perform the safety procedures if I try" (expectancy).

Workers also responded to scales measuring the two types of *safety behaviors* described by Neal and Griffin (2004), as described above. Internal consistency was slightly lower among workers (Safety Compliance Behaviors α = .89; Safety Participation Behaviors α = .89) than supervisors, but both showed more than adequate internal consistency. Finally, *age, gender,* and *organizational tenure* were collected as control variables. Items for the workgroup member survey are presented in Appendix B.

Safety outcomes. Two measures of accidents and injuries were used. First, organizational records were used to measure accidents, and injuries for the broad organizational units in this study. These are commonly referred to as OSHA recordables, which are company records of accidents and injuries required by law. Unfortunately, several researchers have found that accidents and injuries tend to be underreported in official company records (cf. Probst, Brubaker, & Barsotti, 2008).

Probst et al. found that the annual injury rate was more than three times higher when medical insurance records were examined. The current archival data includes workers' compensation claims, which Probst et al. suggest are likely to be more accurate. However, due to confidentiality concerns no individual data was obtained. In addition while it is not certain that underreporting of accidents and injuries occurred within municipal bureau in which the study participants are employed, self-reported accidents and injuries were also elicited from individual workers to be compared with organizational records. All measures used in the study are summarized in Table 6.

Procedure

Participants were sampled using either paper-and-pencil or electronic surveys. Approximately three-fourths of the participants (n = 131) completed paper-and-pencil surveys in small groups, which were scheduled with the help of municipal bureau training staff. The rest of the participants completed the survey via computer as part of an ongoing research/training effort between university faculty and the municipal bureau. Participants who took the paper-and-pencil were mostly from the bureau's main field facility, while those who took the electronic survey tended to work out of other locations, and also had more access to the municipal computer network while at work. A series of t-tests were run to check for differences on all study variables by survey type. Significant differences were found for workers on orderliness ($t_{(144)} = -2.05$, $p < .05$), and altruism ($t_{(144)} = -2.45$, $p < .05$). Given these differences, survey type was used as a control variable in analyses with these two scales. No significant differences were found for supervisors.

The nature of the study was explained to participants completing the paper-and-pencil survey, questions from the group were answered, and they were asked to participate in the study. A cover letter was included with both surveys which explained the study, including potential costs and benefits. In addition, the electronic survey included a letter from the bureau administrator in the e-mail invitation encouraging participation. Completion of the survey was considered evidence of informed consent. A gift card raffle was held to compensate participants for their time and effort.

In order to maintain confidentiality, the names of supervisors and workers were separated from the main data file. A separate file was created with participants' names and a code. Supervisors received a letter code (e.g. A, B, C, etc.) to denote their workgroup, while corresponding workers received an alphanumeric code reflecting their workgroup (e.g. A01, B06). Each participant was identified in the main data file only by their code. The file names with the names and codes was available only to myself, and will not be made available to the municipal bureau in any form. Once all participants are coded, the name-code list was only used to determine the names of the gift card raffle winners. Participants who completed the survey but could not be matched to a workgroup were not included in this study but were eligible for the gift card drawing. All participants who provided their name on a survey were included in a drawing for six $50 Visa gift cards. A total of 221 participants were entered in the drawing making the odds of winning about 1 out of 37.

Analysis Strategy

In this study, individual workers are nested in workgroups which violates the assumption of independent observations in ordinary least squares regression. In addition, group-level safety climate—the aggregated perceptions of group members—is hypothesized to mediate the relationship between supervisors' personality variables and individual workers' safety motivation. Therefore, a combination of hierarchical linear modeling, multiple regression, and path modeling was used to analyze the data.

Chapter VII

Results

Means, standard deviations and 95% confidence limits for all study variables are presented in Table 7 for the individual-level (Level 1) participants, and Table 8 for the supervisor-level (Level 2) participants. Table 9 presents the intercorrelations and internal consistencies of all variables measured at the individual- or worker-level, while Table 10 presents the same for the supervisor- or workgroup- level.

At the supervisor-level (Level 2; see model Figure 1) all instruments showed adequate internal consistency, with αs ranging from .74 to .90. The decision to aggregate worker's individual safety climate perceptions to the workgroup-level was based on the results of a one-way ANOVA, ICC(1), ICC(2), and $R_{wg(j)}$ as recommended by Bliese (2000), Hofmann and Stetzer (1996, 1998) and Hofmann, Morgeson, and Geras (2003). The results of the one-way ANOVA suggest that safety climate varied significantly by workgroup ($F_{(27, 118)} = 3.64$, $p < .001$). Intraclass correlations were calculated from the ANOVA results. The calculation of the ICC(1) takes group size into account. When the size of the groups is unequal, Bliese suggests that the mean group size can often be used. However, when there is considerable variability in group size, as in the current study, Bliese suggests an averaging procedure described by Blalock (1972) which reduces the effect of extreme scores on the mean. Therefore, Blalock's formula to compute average group size was used. The ICC(1) = .31, suggesting that 31% of the variance in safety climate scores was due to group membership. The ICC(2) = .66, suggesting adequate reliability of mean safety

climate scores by group. To assess the within-group consistency of responding compared to a uniform distribution, the $R_{wg(j)}$ was calculated (James, Demaree, & Wolf, 1984). The $R_{wg(j)}$ = .94 suggesting a high level of within-group consistency. Taken together, these statistics provided sufficient evidence to justify aggregation of individual safety climate perceptions to the workgroup-level (see Hofmann & Stetzer, 1996, 1998; Hofmann, Morgeson, & Geras, 2003).

An examination the correlations of variables at the supervisor-level in Table 10 shows no significant correlations between workgroup safety climate perceptions and any measure of supervisor personality. Likewise, the correlation between supervisor perceptions of organizational safety climate and workgroup safety climate perceptions approached zero (r = .06). There were several significant correlations between supervisor personality variables. Proactive personality was significantly correlated with the agreeableness traits of altruism (r = .45, p < .05) and morality (r = .44, p < .05), and the extraversion traits of assertiveness (r = .44, p < .05) and activity level (r = .43, p < .05). Proactive personality was also significantly correlated with organizational safety climate (r = .43, p < .05). Emotional stability, measured as a control variable, showed several significant correlations with the agreeableness and extraversion traits, as well as with organizational safety climate (r = .38, p < .05). Organizational safety climate was significantly correlated with the extraversion traits of friendliness (r = .47, p < .05), assertiveness (r = .44, p < .05), and cheerfulness (r = .42, p < .05), as well as the agreeableness traits of trust (r = .47, p < .05), and altruism (r = .51, p < .01). Finally, the traits of extraversion and agreeableness showed

several significant correlations among intra-factor trait scales, and some significant correlations between trait scales from different factors. Notably, the three trait scales hypothesized to effect workgroup safety climate—cheerfulness, friendliness, and altruism—were all significantly correlated with each other (*r*s =.47 to .76).

At the individual-level all instruments showed adequate internal consistency, with *αs* ranging from .73 to .96 (see Table 9). A confirmatory factor analysis was conducted on the VIES measure of safety motivation, which contains subscales for valence, instrumentality, and expectancy. A second-order latent factor model was fitted with Amos 18 (SPSS, 2009) and showed adequate fit with the data after allowing the error terms for three of the instrumentality items to covary (CMIN (60) = 113.23, CMIN/DF = 1.89; GFI = .898, CFI = .963, RMSEA = .078). Therefore, the total score for the scale will be used to assess study hypotheses. An examination of the correlation matrix in Table 9 shows that VIES scores correlated significantly with self-reported safety compliance behaviors ($r = .51$, $p < .01$), self-reported safety participation behaviors ($r = .47$, $p < .01$), and supervisor ratings of worker's safety compliance behaviors ($r = .44$, $p < .01$), but not supervisor ratings of worker's safety participation behaviors ($r = .27$, *ns*). In addition, VIES scores were significantly correlated with all the traits of agreeableness and conscientiousness (*r*s =.17 to .39). Specifically, the four trait-level measures of worker personality which were hypothesized to have a direct effect on safety motivation (VIES) showed small to moderate, but statistically significant relationships: Orderliness ($r = .26$, $p < .01$), cautiousness ($r = .39$, $p < .01$), altruism ($r = .26$, $p < .01$), and trust ($r = .18$, $p < .05$).

Self-reported safety compliance behaviors showed significant correlations with all trait-level personality measures (*r*s =.21 to .54), while self-reported safety participation behaviors showed significant correlations with all trait-level personality measures except orderliness and modesty (*r*s =.03 to .41). Supervisor's ratings of worker's safety compliance were significantly correlated only with the trait of cautiousness ($r = .42$, $p < .01$), while supervisor's ratings of worker's safety participation behaviors were not significantly correlated with any trait measures of worker's personality. Supervisor ratings of worker's safety compliance and safety participation behaviors were significantly correlated ($r = .73$, $p < .01$). This correlation is higher than those reported in previous studies. Three studies (Griffin & Neal, 2000; Neal & Griffin, 2006; Neal, Griffin, & Hart, 2000) examined workers' self-reports of safety compliance and safety participation behaviors. They reported five correlations between safety compliance and safety participation behaviors (*r*s =.30 to .64). In the current study, the correlation for workers' self-reported safety compliance and safety participation behaviors was $r = .62$. I am unaware of any studies that reported the correlation between supervisors' ratings of workers' safety compliance and safety participation behaviors using the Neal and Griffin scales.

For workers, all the conscientiousness traits were significantly correlated with each other (*r*s =.45 to .81). Similarly, most of the agreeableness traits were significantly correlated with each other (*r*s =.01 to .60). Correlations between traits across factors also showed several significant correlations (*r*s =.00 to .58).

Data Analysis Strategy

In this study, individual workers are nested in workgroups which violates the assumption of independent observations in ordinary least squares regression. In addition, workgroup-level safety climate—the aggregated perceptions of group members—is hypothesized to mediate the relationship between supervisors' personality variables and individual workers' safety motivation. Therefore, a combination of multi-level modeling and multiple regression was used to analyze the data. In addition, replications testing for mediation in the individual section of the model were tested using path analysis. Before beginning the data analysis, missing data was imputed to maximize the sample size. When a participant failed to respond to all the items a given scale, the missing data were replaced with the participant's scale mean. There were twelve instances of missing data, and no scale had more than two participants who neglected to respond to a scale item.

Hypothesis Tests

Hypotheses 1 and 2 pertain to Level 2, the supervisor-level; no cross-level effects are predicted. Multiple regression was used to test these two hypotheses (refer to the study model in Figure 1). Age, gender, and organizational tenure were measured as demographic control variables. However, in order to maximize degrees of freedom, only those control variables which were significantly correlated with outcome variables were included in statistical analyses. In addition, given the small sample size in Level 2 of the model (n = 28), the alpha level to determine statistical significance will be set at .10 one-tailed to maximize statistical power as discussed by Cascio and Zedeck (1983).

Hypothesis 1 predicts that supervisor's perceptions of organizational safety climate will moderate the effect of proactive personality on workgroup safety climate. To test this hypothesis a three step hierarchical regression was conducted. Since none of the control variables (age, gender, and organizational tenure) was significantly related to workgroup safety climate they were not included in either of the Level 2 hypothesis tests. In Step 1 emotional stability was entered as a control variable. In Step 2 the main effects of proactive personality and organizational safety climate were entered. Finally, in Step 3 the interaction of proactive personality and organizational safety climate were entered. Table 11 shows the results of the hierarchical regression.

While none of the effects were statistically significant, the ΔR^2 for Step 2 accounted for 4% more variance than emotional stability in Step 1 , with most of the effect due to proactive personality (β = .23). A two-step hierarchal regression was run without any control variables to maximize degrees of freedom, but no significant relationships were obtained. Therefore, although Hypothesis 1 was not supported, the results suggest that proactive personality accounted for incremental variance in workgroup safety climate, and that the lack of significant results might be due to a lack of statistical power in this analysis.

Hypothesis 2 predicts that three Big Five traits in supervisors—cheerfulness, friendliness, and altruism—would have a direct effect on workgroup safety climate. A two step hierarchical regression was conducted to test this hypothesis. In Step 1 emotional stability was entered as a control variable. In Step 2 the main effects of

cheerfulness, friendliness, and altruism were entered. Table 12 shows the results of the hierarchical regression analysis.

There were no significant predictors of workgroup safety climate. However, Step 2 accounted for an additional 3% of the variance above Emotional Stability. An additional regression was conducted with just the three trait measures as predictors but no significant relationships were obtained. Therefore, although Hypothesis 2 was not supported, the three trait measures of supervisor personality did account for incremental variance in workgroup safety climate above Emotional Stability.

Research Question 1 asks what is the relationship between the traits of extraversion and agreeableness in supervisors and workgroup safety climate? A two-step hierarchical regression was conducted to evaluate the research question. In Step 1 emotional stability was entered as a control variable. In Step 2 the main effects of all the agreeableness and extraversion traits were entered. Table 13 shows the results of the regression analysis. The trait measures of supervisor personality accounted for an additional 60% of the variance in workgroup safety climate above emotional stability ($p < .10$, one-tailed). Several predictors were significant in the final equation including emotional stability, trust, morality, cooperation, sympathy, friendliness, and gregariousness.

While a comparison between the trait and factor measures of supervisors' personality as predictors of aggregated safety climate was not planned, an exploratory analysis using supervisors' factor scores for agreeableness and extraversion was conducted. Factor scores were calculated from trait scores. The resulting measures

showed high reliability: agreeableness $\alpha = .92$ and extraversion $\alpha = .93$. Neither factor scale was significantly correlated with workgroup safety climate, although extraversion was significantly related to emotional stability ($r = .48$, $p < .01$, two-tailed). Given the absence of any significant correlations with safety climate no regressions were conducted.

Hypotheses 3 and 4 pertain to the individual-level, while Hypothesis 5 involves a cross-level effect. These three hypotheses were tested with hierarchical linear modeling.

A series of multi-level tests were used to establish individual- and group-level variance in safety motivation per Hofmann, Griffin, and Gavin (2000). Since safety climate, a group-level variable, is hypothesized to affect safety motivation, an individual-level variable, there must be significant between-group variance in safety motivation. The first test uses a one-way ANOVA model to show that there is meaningful between-group variance in safety motivation. In addition, the total variance is partitioned into within- and between-group components. The following equations will be estimated:

Level 1: $\text{Safety motivation}_{ij} = \beta 0_j + r_{ij}$

Level 2: $\beta 0_j = \gamma 00 + U0_j$

where

$\beta 0_j$ = mean for safety motivation for group j

$\gamma 00$ = grand mean for safety motivation

r_{ij} = within-group variance in safety motivation

$U0_j$ = between-group variance in safety motivation

A chi-square test of $U0_j$ ($\tau 00$) is used to determine if there is significant between-group variance in safety motivation. An intraclass correlation can also be computed which specifies the percentage of total variance residing between groups. The analysis showed that there is significant between-group variance in safety motivation (χ^2 (27; n = 28) = 33.64, $p < .10$, one-tailed), and the ICC = .17 suggests group membership accounts for a moderate portion of the variance in safety motivation.

Given significant between-group variance in safety motivation, the random-coefficient regression model tests the hypothesis that individual-level predictors are associated with significant variance in safety motivation intercepts across groups. This model is similar to ordinary least squares regression except that intercept coefficients are allowed to vary across groups. The following equations will be estimated:

Level 1: $\text{Safety motivation}_{ij} = \beta 0_j + \beta 1_j(\text{cautiousness}) + \beta 2_j(\text{orderliness}) + B3_j(\text{altruism}) + \beta 4_j(\text{trust}) + r_{ij}$

Level 2: $\beta 0_j = \gamma 00 + U0_j$

$\beta 1_j = \gamma 10 + U1_j$

$\beta 2_j = \gamma 20 + U2_j$

$\beta 3_j = \gamma 30 + U3_j$

$\beta 4_j = \gamma 40 + U4_j$

where

$\beta 0_j$ = mean for safety motivation for group $_j$

$\beta 1_j - \beta 4_j$ = slopes for Big Five traits for group $_j$

$\gamma 00$ = mean of the intercepts across groups

$\gamma 10 - \gamma 40$ = mean of slopes for Big Five traits across groups

(Hypotheses 3 & 4)

r_{ij} = level 1 residual variance

$U0_j$ = variance in intercepts

$U1_j - U4_j$ = variance in slopes

A series of t-tests for $\gamma 10 - \gamma 40$ provide direct tests of Hypotheses 3 (a & b) and 4 (a & b), and determine if the Big Five traits of cautiousness, orderliness, altruism, and trust are significantly related to safety motivation. An effect size can also be computed to determine the magnitude of the relationship between the Big Five traits and safety motivation. Table 14 shows the results of this analysis.

The analysis shows that only worker's cautiousness scores significantly predicted safety motivation ($p < .05$, one-tailed). Thus, Hypothesis 3a was supported but Hypotheses 3b and Hypotheses 4 a and 4b were not. The effect size was calculated by comparing the amount of Level 1 error variance in the current model ($\sigma^2 = .242$) with that in the unconditional model ($\sigma^2 = .275$) which had no Level 1 predictors, as suggested by Nezlek (2001). Therefore, the addition of Level 1 predictors accounted for an additional 3.2% of the variance in safety motivation.

The final intercepts-as-outcomes model tests the effect of workgroup safety climate on safety motivation after controlling for Level 1 trait predictors. This model is similar to the random-coefficients regression model with the addition of a Level 2 predictor (safety climate) of the variance in safety motivation intercepts ($\beta 0_j$) across groups. The following equations will be estimated:

Level 1: $\text{Safety motivation}_{ij} = \beta 0_j + \beta 1_j(\text{cautiousness}) + \beta 2_j(\text{orderliness}) + B3_j(\text{altruism}) + \beta 4_j(\text{trust}) + r_{ij}$

Level 2: $\beta 0_j = \gamma 00 + \gamma 01(\text{safety climate}_j) + U0j$

$\beta 1_j = \gamma 10 + U1_j$

$\beta 2_j = \gamma 20 + U2_j$

$\beta 3_j = \gamma 30 + U3_j$

$\beta 4_j = \gamma 40 + U4_j$

where

$\beta 0_j$ = mean for safety motivation for group $_j$

$\beta 1_j – \beta 4_j$ = slopes for Big Five traits for group $_j$

$\gamma 00$ = level 2 intercept

$\gamma 01$ = level 2 slope (Hypothesis 5)

$\gamma 10 – \gamma 40$ = mean of slopes for Big Five traits across groups

r_{ij} = level 1 residual variance

$U0_j$ = residual intercept variance (residual variance across groups)

$U1_j – U4_j$ = variance in slopes

A t-test for $\gamma 01$ determines if safety climate is significantly related to group safety motivation after controlling for Level 1 Big Five traits (Hypothesis 5). A chi-square test for $U0_j$ determines if there is systematic Level 2 variance that can still be modeled. Finally, an effect size can be computed to assess the magnitude of the relationship between safety climate and safety motivation. Table 15 shows the regression results.

The regression results show that workgroup safety climate was a significant predictor ($p < .10$, one-tailed) of variance in safety motivation intercepts after controlling for the effects of the four Big Five traits. Thus, Hypothesis 5 was supported. Cautiousness remained the only significant trait-level predictor of variance in safety motivation intercepts across groups ($p < .05$, one-tailed). The effect size for the addition of workgroup safety climate as a predictor was calculated by comparing the Level 2 error variance in the current model ($\sigma^2 = .241$) with that of the previous model which did not include a Level 2 predictor ($\sigma^2 = .242$), suggesting that workgroup safety climate accounted for only a slight increase in the variance in safety motivation. Finally, there is little variance that could still be modeled ($\chi^2(26; n = 28) = 26.97$, *ns*).

Research Question 2 concerned the effect of workers' conscientiousness traits on individual safety motivation. To test these effects a three-step hierarchical regression was run. Organizational tenure was significantly related to safety motivation and survey type was a significant covariate of orderliness. Therefore, both were entered as control variables in Step 1. In Step 2 individual safety climate

perceptions were entered. In Step 3 all six traits of conscientiousness were entered. Table 16 shows the results of the hierarchical regression. The results show that only individual-level safety climate significantly predicted individual safety motivation. However, the conscientiousness traits accounted for significant incremental variance in safety motivation over controls and safety climate ($\Delta R^2 = .12$, F-change$_{(6, 135)} = 3.48$ $p < .01$).

Research Question 3 concerned the effect of all of the agreeableness traits on individual safety motivation. To test these effects a three-step hierarchical regression was run. As in the previous analysis in Step 1 organizational tenure and survey type were entered as controls. In Step 2 individual safety climate perceptions were entered. Finally, in Step 3 all six traits of agreeableness were entered. Table 17 shows the results of the hierarchical regression. Once again, individual safety climate perceptions were significant predictors of individual safety motivation, accounting for significant incremental variance ($\Delta R^2 = .07$, F-change$_{(1, 141)} = 11.00$, $p < .01$). In addition, the six agreeableness traits accounted for significant incremental variance ($\Delta R^2 = .09$, F-change$_{(6, 135)} = 2.60$, $p < .05$). The only significant agreeableness trait predictor of safety motivation was morality.

Two further exploratory analyses were conducted to determine the effect of workers' conscientiousness and agreeableness factors on individual safety motivation. As described earlier, factor scores were computed from trait scale scores and both scales showed good reliability: conscientiousness ($\alpha = .95$) and agreeableness ($\alpha = .89$). In addition, both factors were significantly correlated with safety motivation

(agreeableness $r = .32$, $p < .01$; conscientiousness $r = .37$, $p < .01$). To test the utility of both factors in predicting safety motivation a three step hierarchical regression was conducted. In Step 1 organizational tenure was entered as a control variable since it was significantly correlated with safety motivation ($r = -.23$, $p < .01$). In Step 2 individual safety climate was entered, and in Step 3 agreeableness and conscientiousness were entered. Table 18 shows the results of the hierarchical regression. In Step 2 individual safety climate accounted for significant additional variance in safety motivation above organizational tenure ($\Delta R^2 = .07$, F-change$_{(1, 142)} = 10.77$, $p < .01$). Likewise, in Step 3 agreeableness and conscientiousness accounted for significant additional variance ($\Delta R^2 = .10$, F-change$_{(2, 140)} = 9.27$, $p < .01$), with conscientious acting as a significant predictor of safety motivation.

Replications

Replication of the individual-level portion of the model (see Figure 1) were tested using path modeling. The model describes fully mediated relationships between safety climate, personality traits, safety motivation, two types of safety behaviors, and accidents and injuries. There are also a number of partially mediated models which can be tested. For example, the relationship between safety climate and safety behaviors may be only partially mediated by safety motivation (cf. Griffin & Neal, 2000; Neal, Griffin, & Hart, 2000). Finally, Barrick, Stewart, and Piotrowski (2002) suggest that motivation mediates the relationship between personality and behavior. Therefore safety motivation will be tested as a mediator of the relationship between workers' Big Five traits and safety behaviors.

According to Baron and Kenny (1986) four conditions are necessary to demonstrate mediation. First, the independent variable must be significantly related to the mediator. Second, the mediator must be significantly related to the dependent variable. Third, the independent variable must be significantly related to the dependent variable. Finally, the relationship between the independent variable and the dependent variable becomes non-significant when the relationships between the independent variable and the mediator, and between the mediator and the dependent variable are controlled.

To satisfy Baron and Kenny's (1986) initial conditions Howell (2002) suggests examining the correlations between the three variables. The hierarchical regressions conducted to evaluate Research Questions 2 and 3, along with an examination of correlations between Level 1 study variables suggests five possible mediation pathways all involving safety motivation as the mediator. First, safety motivation mediates the relationship between safety climate and safety participation behaviors. Second, safety motivation mediates the relationship between cautiousness and safety compliance behaviors. Third, safety motivation mediates the relationship between cautiousness and safety participation behaviors. Fourth, safety motivation mediates the relationship between morality and safety compliance behaviors. Finally, safety motivation mediates the relationship between morality and safety participation behaviors.

Path analysis was used to simultaneously test all five possible mediation pathways. Figure 8 shows the basic path model without mediation pathways, and with

regression coefficients. The model did not fit the data well (χ^2 (16) = 44.96, $p < .01$; CFI = .91; RMSEA = .11). Figure 9 shows the mediation model with regression coefficients. The model fit was improved when the mediating pathways were entered (χ^2 (11) = 6.86, *ns*; CFI = 1.00; RMSEA = .001). The chi-square difference statistic shows the mediation model accounted for significantly more covariance than the basic model ($\chi^2_{difference}$ (4) = 38.10, $p < .001$).

The path analysis showed full or partial mediation for all five of the possible mediation pathways. Sobel's (1982) test was also conducted to evaluate the complete mediation pathway from the independent variable to the mediator to the dependent variable (Howell, 2002). Figure 9 shows that safety motivation partially mediated the relationship between safety climate and safety participation behaviors. Sobel's test was also significant ($z = 2.87$, $p < .01$). Safety motivation partially mediated the relationship between cautiousness and safety compliance behaviors and Sobel's test showed the full pathway was significant ($z = 3.55$, $p < .01$). Likewise, safety motivation partially mediated the relationship between cautiousness and safety participation behaviors and Sobel's test showed the full pathway was significant ($z = 3.34$, $p < .01$). In addition, safety motivation fully mediated the relationship between morality and safety compliance behaviors, and Sobel's test showed the full pathway was significant ($z = 3.49$, $p < .01$). Finally, safety motivation fully mediated the relationship between morality and safety participation behaviors, and Sobel's test showed the full pathway was significant ($z = 3.30$, $p < .01$).

Archival Injury Data

Archival data showed 56 workers' compensation claims in the municipal bureau during the 2010 fiscal year. In contrast, workers' report 601 minor injuries (contusions, scratches, cuts, and slips) and 126 major injuries (burns, sprains, concussions, fractures, hernias, and tendonitis). Probst, et al. (2008) suggested that insurance claims are a more accurate measure of occupational injuries than injuries reported to OSHA. The current data suggest that only about 8% of self-reported injuries resulted in workers' compensation claims. This could be due to over-reporting of injuries by workers in the current study, or under-reporting of injuries by workers to the organization.

Summary of Results

The current study tested a multi-level model of the relationships between supervisors' personality and supervisor's perceptions of organizational safety climate perceptions on worker group safety climate perceptions in Level 2, and the relationship of workers' personality traits on safety motivation in Level 1 (see Figure 1). In addition, Level 1 of the model posits fully mediated relationships between safety climate, safety motivation, workers' personality traits, safety behaviors, and self-reported injuries which were also tested where appropriate (cf. Baron & Kenny, 1986).

Hypotheses 1 and 2 correspond to Level 2 of the model and were tested with hierarchical regression. Hypothesis 1 posits that supervisor's perceptions of organizational safety climate perceptions will moderate the relationship between supervisors' proactive personality and workgroup safety climate. While Hypothesis 1

was not supported, proactive personality did account for substantial variance in workgroup safety climate. Hypothesis 2 posited that three Big Five traits (cheerfulness, friendliness, and altruism) would have a direct effect on workgroup safety climate. Again, while Hypothesis 2 was not supported, the three personality traits accounted for an additional 3% of the variance in workgroup safety climate over controls. Research Question 1 asked what was the relationship between all the traits of agreeableness and extraversion and workgroup safety climate? Several of the traits (trust, morality, cooperation, sympathy, friendliness, and gregariousness)were significant predictors of workgroup safety climate, and taken together, all the traits of agreeableness and extraversion accounted for an additional 60% of the variance in workgroup safety climate. Finally, agreeableness and extraversion factors were tested to see if they predicted workgroup safety climate, which they did not.

Hypotheses 3a, 3b, 4a, and 4b pertain to Level one of the model, and posit the four Big Five traits in workers, cautiousness (3a), order (3b), altruism (4a), and trust (4b) would have a direct effect on safety motivation. These hypotheses were tested using hierarchical linear modeling. Cautiousness was the only significant predictor of safety motivation, accounting for an additional 3.2% of the variance in safety motivation over individual safety climate. Hypothesis 5 involved a cross-level effect and posited the workgroup safety climate would be a significant predictor of individual safety climate, after controlling for the effects of the individual predictors (cautiousness, order, altruism, and trust) in Hypotheses 3 and 4. This was also tested with hierarchical linear modeling. Workgroup safety climate was a significant

predictor of individual safety motivation, although the effect size was quite small at less than one percent.

Research Questions 2 and 3 asked what is the relationship between all the traits of conscientiousness and agreeableness and safety motivation? These research questions were evaluated using ordinary least squares hierarchical regression. Of the 12 traits tested, only the agreeableness trait of morality was a significant predictor of safety motivation. Finally, conscientiousness and agreeableness factors were tested to see if they predicted safety motivation. Only conscientiousness was a significant predictor of safety motivation.

Lastly, as a replication of previous studies (Griffin & Neal, 2000; Neal & Griffin, 2006; Neal, Griffin, & Hart, 2000) the fully mediated Level 1 section of the model was tested. As with previous studies, the model was not fully mediated. Safety motivation partially mediated the relationship between individual safety climate and safety participation behaviors. Likewise, safety motivation partially mediated the relationships between cautiousness and safety compliance behaviors, and safety participation behaviors. Finally, safety motivation fully mediated the relationships between morality and safety compliance behaviors, and safety participation behaviors. Figure 10 shows the study model and which hypotheses were supported.

Chapter VIII

Discussion

The primary goals of this study were to examine the relationship of supervisor's personality variables to the development of workgroup safety climate perceptions, and to examine the effect workers' Big Five traits on safety motivation and safety behaviors. In addition, this study gathered further evidence on the validity of the VIES with maintenance and construction workers, and provided another test of Neal and Griffin's (2004) fully mediated model of the relationship between safety motivation, safety behaviors, and safety outcomes. In this discussion I will review the general findings of the study, discuss the implications for safety research and practice, review potential limitations of the study, and suggest avenues for future research.

General Findings

While neither of the hypotheses regarding supervisors' personality variables and workgroup safety climate perceptions were supported, possibly due to low statistical power, the regression results suggest further study is warranted. While the correlations between supervisors' proactive personality, organizational safety climate perceptions, and workgroup aggregated safety climate were not significant, proactive personality and organizational safety climate accounted for an additional 4% of the variance, over emotional stability, in workgroup safety climate perceptions, with most of the effect due to proactive personality. The hypothesized moderating effect of supervisors' organizational safety climate perceptions on the relationship between

proactive personality and workgroup aggregated safety climate perceptions was also not supported.

Likewise, none of the three trait-level measures of supervisor's personality—altruism, friendliness, cheerfulness—were significant predictors of workgroup safety climate. However, together they accounted for an additional 3% of the variance, over emotional stability, in workgroup safety climate perceptions. Of the three traits, supervisor cheerfulness had the strongest effect, although none of the βs was significant. Similarly, an exploratory examination of the relationship between all the traits of extraversion and agreeableness, and workgroup safety climate perceptions found several of the traits to be significant predictors. Together the trait predictors accounted for an additional 60% of the variance in workgroup safety climate perceptions above emotional stability, with trust having the strongest effect.

These results suggests that a manager's personality traits may play an important role in the implementation of the organizational approach to safety which relies on getting workers to "buy-in" to the organization's safety goals and safety management program, and to work to achieve these goals. Social exchanges (Gouldner, 1960) and the norm of reciprocity (Blau, 1964) motivate this process as studies on leadership styles and LMX have suggested (Barling, Loughlin, and Kelloway, 2002; Hofmann, Morgeson, and Geras, 2003; Kelloway, Mullen, and Francis, 2006; Mullen and Kelloway, 2009). Recent studies have also shown the importance of workers' trust in management in the formation of a strong safety climate and the performance of safety behaviors (Conchie & Donald, 2009; Luria, 2010). Likewise, Conchie and

Burns (2009) showed that workers' trust of their supervisor as a source of information about safety risks was more dependent on supervisors' demonstrations of caring than on the accuracy of the information they provided. While none of the supervisor personality variables in this study were significantly related to workgroup safety climate, the fact that agreeableness and extraversion traits accounted for significant incremental variance in safety climate suggests that further study is warranted.

Trait-level measures of workers' personality also showed some significant relationships to workers' safety motivation, even though three of the four hypotheses regarding workers' personality were not supported. All of the trait-level measures showed significant positive bivariate correlations with safety motivation. Cautiousness and workgroup safety climate were the only significant predictors of workgroup safety motivation in a hierarchical linear model. Exploratory analyses of all the conscientious and agreeableness traits showed that morality was the only trait which significantly predicted individual safety motivation using ordinary least squares regression. Morality corresponds to straightforwardness from the NEO-PI (McCrae & Costa, 1992) and refers to the tendency to follow rules. In addition, while none of the conscientiousness traits was a significant predictor of individual safety motivation, together they accounted for an additional 12% of the variance, over individual safety climate perceptions, in safety motivation. Similarly, the agreeableness traits accounted for an additional 9% of the variance, over individual safety climate perceptions, in safety motivation.

These results are congruent with current models of safety variables and outcomes. Zohar's (2003a) model suggests that the broad organizational safety climate and the narrower workgroup safety climate both affect behavior-outcome expectancies which lead to safety behaviors and ultimately to accidents and injuries. While the main focus of Zohar's model is on the organizational- and group-level environment, including co-workers and supervisors, personality variables also affect behavior-outcome expectancies (Mishel, 2004). Similarly, the Neal and Griffin (2004) model lists four precursors of safety knowledge and safety motivation: Safety climate, organizational factors, individual attitudes, and individual differences. Several studies have found relationships between individual differences and safety outcomes, and the current results suggest that trait-level personality measures can account for incremental variance in safety motivation over individual safety climate perceptions.

A *post hoc* analysis of the relationships between conscientiousness and agreeableness factors and safety motivation showed that together the two factors accounted for an additional 10% of the variance in safety motivation above safety climate, and conscientiousness was a significant predictor. If upon further study the trait of cautiousness is found to be a consistent predictor of safety motivation, it may help to resolve some of the inconsistent results in previous studies of conscientious and safety.

Replication analyses of the Level 1 portion of the model showed that safety motivation mediated the relationships between safety climate, cautiousness, and morality, and both safety compliance and safety participation behaviors. Safety

motivation partially mediated the relationship between safety climate and safety participation behaviors. These results are in line with those of Neal, Griffin, and Hart (2000) while using a different measure of safety motivation (Truxillo, et al., 2006, 2007). Similarly, Barrick, Stewart, and Piotrowski (2002) reported that motivation mediates the relationship between Big Five personality factors and job performance. In the current study safety motivation fully mediated the relationship between morality and both safety compliance behaviors, and safety participation behaviors. Thus, the primary effect of morality—the tendency to follow rules—is to increase safety motivation. On the other hand, safety motivation only partially mediated the relationship between cautiousness and both safety compliance and safety participation behaviors. In this case it appears that personality traits can have an independent effect on job performance over and above motivation.

The prediction of accidents and injuries has traditionally been difficult because they are infrequent events. In the current study, self-reported injuries showed few significant correlations with other study variables (see Table 9). Minor injuries were negatively related to age, and major injuries were negatively related to both safety compliance and safety participation behaviors. Safety behaviors were significant predictors of minor injuries; neither type of safety behavior predicted major injuries (see Figure 9). While the negative relationship between safety participation behaviors and self-reported minor injuries is expected, safety compliance behaviors were positively related to self-reported minor injuries. It may be that as workers comply with safety procedures they become more safety sensitive and more likely to

remember the occurrence of minor injuries and to report them when asked. On the other hand, having experienced an injury could also lead workers to become more safety sensitive, expend more effort to follow safety rules and procedures, and to remember and report subsequent injuries. As Beus et al. (2010) reported, injuries have a strong negative effect on safety perceptions at the group-level. These results, along with previous studies, suggest that the Neal and Griffin (2004) model is not necessarily a fully mediated model, although it is still useful for conceptualizing distal and proximal antecedents of accidents and injuries. Furthermore, this is the first study to show that Big Five traits can predict safety motivation and safety behaviors.

Implications for Research

This is the first study I am aware of to examine the effects of supervisors' personality on the development of workgroup safety climate. Despite the lack of statistical significance, the results suggest that proactive personality and Big Five traits can account for incremental variance in workgroup safety climate perceptions. Supervisors play a major role in the development of workgroup safety climate by monitoring safety behaviors, responding to safety issues, and taking an active interest in workers' welfare. The current study increases our knowledge by showing that supervisors' personality variables could affect their ability to convey the importance of safety to their subordinates. Recent studies (Conchie & Burns, 2009; Conchie & Donald, 2009) show that workers' trust in supervisors has an effect on supervisors' ability to promote safety in their workgroups. In addition, several studies show the importance of the workgroup social environment in promoting workplace safety

(Luria, 2008; Nahrgang, Morgeson, & Hofmann, 2011; Tucker, et al., 2008; Zohar & Tene-Gazet, 2008). Future studies should examine supervisory behaviors and personality traits that facilitate trust in management and positive social interactions in the workgroup, and also encourage safe behaviors. In addition to comparing the predictive utility of factors and traits, future studies could examine the relative utility of self- and other-rated supervisor personality traits.

Similarly, workers' personality is not a major focus of safety professionals' efforts to improve workplace safety. We have rightly discarded the notion of the accident prone personality and focused instead on environmental interventions with the implementation of safety management systems, an interpersonal approach which stress concern for workers' health and welfare by the organization, supervisors, and co-workers. Nevertheless, the current study shows that workers' personality traits can account for significant incremental variance in safety motivation and safety behaviors over safety climate perceptions. Specifically, cautiousness was positively related to the safety motivation and safety behaviors, and morality was predictive of safety motivation. These results advance our knowledge by showing that trait-level measures can predict important safety outcomes, and, with further research, might help us to better understand how safety climate and safety motivation develop in workgroups. In the same vein, workers' personality traits might differentially affect perceptions of valence, instrumentality, and expectancy on the VIES.

Once important traits in either supervisors or workers are established, an intervention could be developed to increase behaviors in supervisors and/or workers

which tend to occur more often in those with certain personality characteristics. In this case it would be important to control for pre-training levels of the trait(s) in question as Scandura and Graen (1984) found with their program to improve LMX relationships.

Finally, this study provided further validity evidence for the VIES scale of safety motivation with workers whose job sites often contain multiple safety hazards. The basic factor structure of the scale was confirmed, and the scale showed the same relationships with safety climate and safety behaviors as previously published scales.

Implications for Practice

The main implications for practice from the current study involve the selection and training of supervisors. Proactive personality has been related to a variety of behaviors, cognitions, and outcomes. Proactive personality leads to behaviors and cognitions such as voice, innovation, political knowledge, and career initiative, which in turn lead to career success (Siebert, Kraimer, & Crant, 2001). Proactive personality has also been related to a number of outcomes including a higher level of extracurricular activities, personal achievements, peer ratings of transformational leadership, relationship building, and charismatic leadership (Bateman & Crant, 1993). The current study suggests that proactive personality may also be related to the development of a positive workgroup safety climate. Therefore, including a measure of proactive personality in the selection process for managers, especially those that supervise safety sensitive jobs, could lead to hiring managers who are better at promoting safety. Managers can also be taught to perform behaviors typical of those

high in proactive personality through direct instruction, modeling, and coaching, even if they do not have a natural tendency to do so. This could be especially helpful in the blue collar sector where first level managers often come up through the ranks.

Supervisor training could build on an intervention by Scandura and Graen (1984) to improve LMX relationships. Their 12-hour training covered the basic LMX model, active listening skills, exchanging mutual expectations and resources, and practicing in one-on-one sessions. The scope of mutual expectations and resources could be expanded to include a safety focus, along with proactive problem-solving and subsequent efforts to improve safety. Supervisors can also be trained to effect change. Research suggests that arguments for change work best when they reflect prosocial organizational values and are expressed with low negative affect (Grant, Parker, & Collins, 2009). Changes in supervisor and workgroup behavior could be measured during and after training using experience sampling methodology (Alliger & Williams, 1993) which entails random sampling of supervisor interactions using short one-page questionnaires. Data could also be collected electronically on telephones or notepad computers. While this would initially be carried out by training or research staff, ideally it could be worked into the day-to-day work routine.

Regarding workers, cautiousness had a direct effect on safety behaviors independent of safety motivation. Workers high in cautiousness are likely to be sensitive to safety concerns and motivated to act safety (safety compliance) and to seek out ways to improve safety in general (safety participation). Several authors (Griffin & Neal, 2000; Truxillo et al., 2006, 2007) have argued that safety compliance

behaviors and safety participation behaviors correspond to the constructs of task and contextual behaviors (Borman & Motowidlo, 1993), respectively. Contextual behaviors are usually considered to be voluntary, and involve employees acting beyond their basic job tasks to help the organization and their co-workers. Safety participation behaviors should be related to the success of organizational approaches to safety, which rely not only on adherence to safety rules and procedures, but also having workers adopt the organization's safety goals and work to achieve them. Since no set of safety rules and procedures can cover every possible situation that workers might encounter, these contextual safety-related behaviors help to maintain a safe working environment. Managers should be trained to monitor and reward both adherence to safety rules and procedures and safety-related contextual behaviors.

Limitations and Future Research

The main limitation of the current study was a lower than optimal sample size at the supervisor-level (Level 2) of the model, which may have decreased the statistical power of for the regressions testing the relationship between supervisors' personality and workgroup aggregated safety climate. The results suggest supervisors' personality affects workers' safety climate perceptions, and future research should examine these possible relationships with a larger sample size.

A second limitation was the failure of most supervisors to provide ratings of their subordinates' safety behaviors. Many of the supervisors refused to provide the ratings either verbally or by omission. Some expressed reluctance and discomfort, while others rated their workgroup as a whole, rather than rating individual workers.

This could be due to the length of the survey, which took about 30 minutes to complete, and even though the survey was filled out during the workday, participants may have been eager to begin working and not fall behind schedule. It could also be because supervisors were uncomfortable rating their subordinates and giving these ratings to an outside researcher. These supervisor ratings are potentially useful, especially for safety participation behaviors, as the supervisors ratings were negatively correlated with workers self-reports of safety participation behaviors. In the future, studies seeking to gather supervisor ratings of safety behaviors could employ shorter surveys, have separate sessions with supervisors for the sole purpose of obtaining these ratings, and address any concerns they may have about rating subordinates.

The current study also did not directly compare the predictive utility of factor-level Big Five measures with trait-level measures, because of concerns for the length of the survey. Some post hoc analyses were conducted, yet the results do not definitively weigh in on the fidelity vs. bandwidth question because trait-level measures were used to predict narrow constructs (safety climate, safety motivation, safety behaviors). However, this study did demonstrate some predictive utility of Big Five traits in the safety domain. Future studies should continue to explore these relationships and provide a direct test of the fidelity vs. bandwidth question.

A final potential limitation pertains to the organization which was the focus of this research. The sample was composed of blue-collar workers, and overwhelmingly male. In addition, this organization has a strong safety management program already in place. Zohar and Luria (2005) have demonstrated that as supervisors' discretion

over work processes decreases, they have less effect on the safety practices of their subordinates. A strong safety management program is likely to reduce supervisors' safety-related discretion and result in more compliance with safety rules and procedures. This could necessitate greater power to detect an effect in this sample. Similarly, Graen (2007) suggests that we examine how leaders' personal attributes interact with the situational properties to affect organizational outcomes. Therefore, the gender and work experience of this sample could affect the type of supervisor traits and behaviors that lead to a strong, positive safety climate. Future studies should explore these possibilities and attempt to determine which leader attributes are most likely to lead to desired organizational outcomes within and across settings.

Conclusion

This study examined the relationship between supervisors' personality and workgroup safety climate perceptions, as well as the effect of workers' personality on safety motivation and safety behaviors. While neither of the hypotheses regarding supervisors' personality were supported, the evidence suggests that supervisors' proactive personality and traits of agreeableness and extraversion accounted for incremental variance in workgroup safety climate. Similarly, for workers, cautiousness was a significant predictor of safety motivation. Replication analyses showed that safety motivation mediated the relationship between workers' safety climate perceptions and personality traits, and safety behaviors. Finally, implications for practice are discussed and further research is proposed that could broaden our

understanding of the role of personality—especially in supervisors—in successful organizational safety management programs.

Table 1

Safety Climate Studies by Country of Origin.

Country	Number of Studies	Studies Cited
United States	20	Cooper & Phillips (2004); DeJoy et al. (2004); Gaba et al. (2003); Goldenhar et al. (2003); Hofmann & Mark (2006); Hofmann & Morgeson (1999); Hofmann et al. (2003); Hofmann & Stetzer (1996, 1998); Huang et al. (2004, 2006); Huang, Ho, & Chen (2006); Janssens et al. (1995); McGovern et al. (2000); Prussia et al. (2003); Seo et al. (2004); Smith et al. (2006); Wallace & Chen (2006); Wallace et al. (2006); Watson et al. (2005)
Israel	7	Katz-Navon et al. (2005); Naveh et al. (2005); Zohar (1980, 2000, 2002); Zohar & Luria (2003, 2005)
Australia	6	Coyle et al. (1995); Fogarty (2005); Fullarton & Stokes (2007); Griffin & Neal (2000); Neal & Griffin (2006); Neal et al. (2000)
United Kingdom	6	Cheyne et al. (1998, 2002); Mearns et al. (1998, 2004); Mearns, Whitaker, & Flin (2001, 2003)
Canada	4	Barling & Hutchinson (2000); Barling et al. (2002); Kelloway et al. (2006); Zacharatos et al. (2005)
France	2	Cheyne et al. (1998); Janssens et al. (1995)
Spain	1	Diaz & Cabrera (1997)
Norway	1	Havold (2005)
Denmark	1	Nielsen et al. (2002)
Portugal	1	Silva et al. (2004)
Finland	1	Varonen & Mattila (2000)
Hong Kong	1	Siu et al. (2004)

Table 2

Safety Climate Studies by Industrial Sector.

Industrial Sector	Number of Studies	Example Studies
Manufacturing	15	Brown & Holmes (1986); Cheyne et al. (1998, 2002); Clarke (2006b); Cooper & Phillips (2004); Griffin & Neal (2000); Hofmann & Morgeson (1999); Nielsen et al. (2006); Prussia et al. (2003); Watson et al. (2005); Zacharatos et al. (2005); Zohar (1980, 2000, 2002); Zohar & Luria (2005)
Construction	6	Dedobbeleer & Beland (1991); Gillen et al. (1997, 2002); Goldenhar et al. (2003); Matilla et al. (1994); Siu et al. (2004)
Health Care	9	Gershon et al. (1998); Katz-Navon et al. (2005); Gaba et al. (2003); Hofmann & Mark (2006); McGovern et al. (2000); Naveh et al. (2005); Neal & Griffin (2006); Neal et al. (2000);Schaefer & Moos (1996)
Offshore Oil Rigs	4	Mearns et al. (1998, 2004); Mearns, Whitaker, & Flin (2001, 2003)
Shipping & Transportation	3	Havold (2005); Huang et al. (2004); Wallace et al. (2006)
Maintenance	2	Wallace & Chen (2006); Zohar (2002)
High Reliability Industries	2	Gaba et al. (2003); Hofmann & Stetzer (1996)
Wood Processing	1	Varonen & Matilla (2000)
Airport Ground Handling	1	Diaz & Cabrera (1997)
Utilities	1	Hofmann & Stetzer (1998)
Clerical/Service	1	Coyle et al. (1995)
Retail	1	DeJoy et al. (2004)
Road Administration	1	Niskanen (1994)
Military	1	Hofmann, Morgeson, & Gerras (2003)
Several Sectors	4	Huang et al. (2004, 2006); Smith et al. (2006)

Table 3

Comparison of Internal Consistency and Validity between Trait and Factor Measures.

Study	Trait Measures		Factor Measures	
	Reliability	Validity	Reliability	Validity
Paunonen & Ashton (2001a)	.54 to .88	.19 to .50 [a]	All over .85.	.17 to .48 [a]
Paunonen (1998)	.59 to .91	-.42 to .47 [b]	.75 to .88	-.32 to .30 [b]
Moon (2001)	.62 to .72	-.12 to .15 [c]	.89	.02 [c]
Stewart (1999)	.71 to .78	-.13 to .27 [d]	.91	-.13 to .16 [d]

Note. a) Multiple correlations; b) Partial correlations; c) βs in hierarchical regression; d) Zero-order correlations.

Table 4

NEO-PIR Trait Descriptions.[a]

NEO-PIR Trait	Adjective Checklist Correlates
Neuroticism traits:	
Anxiety	Anxious, fearful, worrying, tense, nervous, (-) confident, (-) optimistic
Angry Hostility	Anxious, irritable, impatient, excitable, moody, tense (-) gentle
Depression	Worrying, pessimistic, moody, anxious, (-) contented, (-) confident, (-) self-confident,
Self-consciousness	Shy, timid, defensive, inhibited, anxious, (-) self-confident, (-) confident
Impulsiveness	Moody, irritable, sarcastic, self-centered, loud, hasty, excitable
Vulnerability	Anxious, careless, (-) clear-thinking, (-) self-confident, (-) confident, (-) efficient, (-) alert
Extraversion traits:	
Warmth	Friendly, warm, sociable, cheerful, affectionate, outgoing, (-) aloof
Gregariousness	Sociable, outgoing, pleasure-seeking, talkative, spontaneous, (-) aloof, (-) withdrawn
Assertiveness	Aggressive, assertive, self-confident, forceful, enthusiastic, aggressive, active
Activity	Energetic, hurried, quick, determined, enthusiastic, aggressive, active
Excitement Seeking	Pleasure-seeking, daring, adventurous, charming, handsome, spunky, clever
Positive Emotions	Enthusiastic, humorous, praising, jolly spontaneous, pleasure-seeking, optimistic
Openness traits:	
Fantasy	Dreamy, imaginative, humorous, mischievous, idealistic, artistic, complicated
Aesthetics	Imaginative, artistic, original, enthusiastic, inventive, idealistic, versatile
Feelings	Excitable, spontaneous, insightful, imaginative, affectionate, talkative, outgoing
Actions	Interests wide, imaginative, adventurous, optimistic, talkative, versatile, (-) mild
Ideas	Idealistic, interests wide, inventive, curious, original, imaginative, insightful

Table 4 (continued)

Values	Unconventional, flirtatious, (-) conservative, (-) cautious
Agreeableness traits:	
Trust	Forgiving, trusting, peaceable, (-) wary, (-) suspicious, (-) hard-hearted
Straightforwardness	(-) complicated, (-) demanding, (-) clever, (-) flirtatious, (-) charming, (-) shrewd, (-) autocratic
Altruism	Warm, soft-hearted, gentle, generous, kind, tolerant, (-) selfish
Compliance	(-) stubborn, (-) demanding, (-) headstrong, (-) impatient, (-) intolerant, (-) outspoken, (-) hard-hearted
Modesty	(-) show-off, (-) clever, (-) assertive, (-) argumentative, (-) self-confident, (-) aggressive, (-) idealistic
Tender-Mindedness	Friendly, warm, sympathetic, soft-hearted, gentle, kind, (-) unstable
Conscientiousness traits:	
Competence	Efficient, self-confident, thorough, resourceful, confident, intelligent, (-) confused
Order	Organized, thorough, efficient, precise, methodical, (-) absent-minded, (-) careless
Dutifulness	Thorough, (-) defensive, (-) distractible, (-) careless, (-) lazy, (-) absent-minded, (-) fault-finding
Achievement Striving	Thorough, ambitious, industrious, enterprising, determined, confident, persistent
Self-Discipline	Organized, efficient, energetic, thorough, industrious, (-) lazy, (-) absent-minded
Deliberation	Thorough, (-) hasty, (-) impulsive, (-) careless, (-) impatient, (-) immature, (-) moody

Note. a) From McCrae & Costa (1992)

Table 5

Safety Motivation Items from Griffin, Neal, and Colleagues.

Griffin & Neal (2000)–Two Factor Version

Motivation to Comply
1. I feel that adhering to tagout/lockout procedures is worthwhile.
2. I believe that it is important to always use safe/standard work procedures.
3. I believe that it is important to consistently use the correct personal protective equipment.
4. I feel that it is worthwhile using my personal protective equipment in the defined areas.
5. I feel that adhering to safe/standard procedures is important in my job.

Motivation to Participate
6. I feel that it is worthwhile to be involved in the development of safe/standard work procedures.
7. I believe that it is important to promote the safety program.
8. I feel that it is important to encourage others to use safe practices.
9. I believe that it is worthwhile to put extra effort into maintaining safety.
10. I believe that it is worthwhile to volunteer for safety related tasks.
11. I believe that it is important to help my coworkers in unsafe or hazardous conditions.

Neal, Griffin, & Hart (2000)–Single Factor Version

1. I believe that workplace health and safety is am important issue.
2. I feel that it is worthwhile to put in effort to maintain or improve my personal safety.
3. I feel that it is important to maintain safety at all times.
4. I believe that it is important to reduce the risk of accidents and incidents in the workplace.

Table 6

Study Measures.

Measure (Hypothesis)	Self-Report	Supervisor-Report	Archival
Proactive Personality (1)[a]	S		
Extraversion Traits			
Cheerfulness (2a)	S		
Friendliness (2b)	S		
Gregariousness	S		
Assertiveness	S		
Activity Level	S		
Excitement-seeking	S		
Agreeableness Traits			
Altruism (2c; 4a)	S, W		
Trust (4b)	S, W		
Morality	S, W		
Cooperation	S, W		
Modesty	S, W		
Sympathy	S, W		
Conscientiousness Traits[b]			
Cautiousness (3a)	W		
Orderliness (3b)	W		
Self-efficacy	W		
Dutifulness	W		
Self-discipline	W		
Achievement-striving	W		
Safety-Related Measures			
Safety Climate[c]	W		
Safety Motivation[d]	W		
Safety Compliance Behaviors[e]	W	W	
Safety Participation Behaviors[e]	W	W	
Demographics (age, gender, job tenures)	S, W		
Safety Outcomes (Accidents, injuries)	W		W

Note. a) Siebert, Crant & Kraimer (1999); b) Goldberg (1999); c) Zohar (2000); d) Truxillo, et al. (2006, 2007); e) Griffin & Neal (2006);
S = Supervisors; W = Workgroup members.

Table 7

Descriptive Statistics for Individual-Level Study Variables.

				95% CI	
Variable	n	M	SD	Lower	Upper
Age	143	44.16	10.72	42.39	45.93
Gender	146	.91	.28	.86	.96
Organizational Tenure	145	9.66	7.37	8.45	10.87
Safety Climate	146	3.63	.61	3.53	3.73
VIES (safety motivation)	146	4.18	.53	4.09	4.26
Safety Compliance Behaviors	146	4.12	.66	4.02	4.23
Safety Participation Behaviors	146	3.69	.77	3.57	3.82
Supervisor Rated Safety Compliance Behaviors	40	4.12	.79	3.86	4.37
Supervisor Rated Safety Participation Behaviors	40	3.70	.85	3.43	3.97
Self-Efficacy	146	4.33	.50	4.25	4.42
Orderliness	146	4.09	.60	3.99	4.19
Dutifulness	146	4.46	.46	4.39	4.53
Achievement-Striving	146	4.12	.62	4.02	4.23
Self-Discipline	146	3,87	.68	3.76	3.98
Cautiousness	146	3.90	.74	3.78	4.02
Trust	146	3.60	.73	3.48	3.72
Morality	146	4.00	.82	3.86	4.13
Altruism	146	3.94	.68	3.83	4.05
Cooperation	146	3.66	.81	3.53	3.79
Modesty	146	3.59	.70	3.47	3.70
Sympathy	146	3.51	.77	3.39	3.64
Self-Reported Minor Injuries	146	3.44	6.50	2.38	4.50
Self-Reported Major Injuries	146	.69	1.66	.41	.96
Self-Reported Missed Days	146	.56	1.81	.27	.86

Table 8

Descriptive Statistics for Supervisor-Level Study Variables.

				95% CI	
Variable	n	M	SD	Lower	Upper
Age	28	46.96	7.38	44.10	49.83
Gender	28	.93	.26	.83	1.03
Organizational Tenure	28	14.80	7.82	11.77	17.84
Aggregated Safety Climate	28	3.68	.42	3.52	3.85
Organizational Safety Climate	28	3.49	.49	3.30	3.68
Proactive Personality	28	5.00	.73	4.72	5.28
Emotional Stability	28	3.66	.60	3.43	3.90
Trust	28	3.56	.55	3.35	3.77
Morality	28	4.00	.84	3.68	4.32
Altruism	28	3.90	.58	3.68	4.12
Cooperation	28	3.49	.78	3.19	3.79
Modesty	28	3.45	.80	3.14	3.76
Sympathy	28	3.80	.69	3.54	4.07
Friendliness	28	3.59	.66	3.34	3.85
Gregariousness	28	3.14	.79	2.83	3.44
Assertiveness	28	3.84	.61	3.60	4.07
Activity Level	28	3.92	.60	3.70	4.15
Excitement Seeking	28	2.84	.71	2.57	3.12
Cheerfulness	28	3.67	.56	3.46	3.89

Table 9

Intercorrelations and Internal Consistencies for Workers (Level 1).

Variable	1	2	3	4	5	6	7	8	9	10	11	12
1. Age												
2. Gender	.08											
3. Organizational Tenure	.59**	.05										
4. Safety Climate	-.09	-.06	-.09	.88								
5. VIES (safety motivation)	.00	-.03	-.23**	.28**	.93							
6. Safety Compliance Behaviors	-.15	.07	-.24**	.12	.51**	.89						
7. Safety Participation Behaviors	.05	.02	-.08	.25**	.47**	.62**	.87					
8. Supervisor Rated Safety Compliance Behaviors	-.14	-.06	-.30	.16	.44**	.20	.03	.96				
9. Supervisor Rated Safety Participation Behaviors	-.08	-.09	-.22	.14	.27	.13	.08	.73**	.93			
10. Self-Efficacy	-.06	.09	-.11	.01	.23**	.33**	.24**	.16	.11	.88		
11. Orderliness	-.05	-.02	-.17*	.17*	.26**	.34**	.15	.07	.12	.45**	.83	
12. Dutifulness	-.10	-.04	-.17*	.12	.25**	.42**	.29**	.11	.10	.62**	.54**	.73
13. Achieve-Striving	-.08	-.01	-.17*	.10	.32**	.48**	.36**	.24	.23	.59**	.60**	.63**
14. Self-Discipline	-.06	.12	-.20*	.10	.38**	.54**	.41**	.19	.20	.56**	.64**	.62**
15. Cautiousness	-.14	.06	-.28**	.04	.39**	.55*	.34**	.42**	.28	.51**	.51**	.57**
16. Trust	-.19*	-.02	-.12	.18*	.18*	.26**	.20*	.14	-.03	.13	.23**	.33**
17. Morality	-.09	.00	-.21*	.05	.34**	.39**	.24**	.20	.01	.35**	.40**	.47**
18. Altruism	-.35**	-.09	-.24**	.18*	.26**	.40**	.38**	.00	-.05	.20*	.21*	.40**
19. Cooperation	-.17*	-.01	-.21*	.22*	.20*	.36**	.20*	-.04	-.15	.00	.25**	.17*
20. Modesty	.02	.13	-.08	.19*	.17*	.21*	.03	.18	.06	.00	.28**	.05
21. Sympathy	-.02	-.23**	-.02	.12	.18*	.23**	.34**	-.01	-.15	.03	.09	.22**
22. Minor Injuries	-.29**	.01	-.11	.02	.00	.09	-.10	.04	-.08	.00	-.02	.-07
23. Major Injuries	-.11	-.13	-.02	.11	-.16	-.18*	-.18*	-.05	-.07	-.02	-.03	-.12
24. Missed Days	.02	-.06	-.05	-.15	.05	-.03	-.02	.09	.09	-.05	-.09	-.07

Table 9 (continued)

Variable	13	14	15	16	17	18	19	20	21	22	23	24
1. Age												
2. Gender												
3. Organizational Tenure												
4. Safety Climate												
5. VIES (safety motivation)												
6. Safety Compliance Behaviors												
7. Safety Participation Behaviors												
8. Supervisor Rated Safety Compliance Behaviors												
9. Supervisor Rated Safety Participation Behaviors												
10. Self-Efficacy												
11. Orderliness												
12. Dutifulness												
13. Achieve-Striving	.90											
14. Self-Discipline	.81**	.89										
15. Cautiousness	.64**	.73**	.81									
16. Trust	.25**	.31**	.34**	.89								
17. Morality	.49**	.58**	.53**	.27**	.82							
18. Altruism	.39**	.42**	.37**	.60**	.44**	.87						
19. Cooperation	.16	.21*	.29**	.43**	.27**	.41**	.74					
20. Modesty	.22**	.22**	.24**	.08	.20*	.01	.35**	.74				
21. Sympathy	.20*	.15	.18*	.32**	.21*	.56**	.31**	.09	.79			
22. Minor Injuries	.05	.04	.05	.07	-.01	.14	.16*	.11	.03			
23. Major Injuries	.02	-.05	-.12	-.12	-.10	.02	-.03	.11	.03	.60**		
24. Missed Days	.03	.01	.05	-.11	.01	-.09	.02	-.05	-.09	.47**	.35**	

Note. Cronbach's α reliabilities on the diagonal. N = 146 except Nos. 8 and 9 where N = 40. Gender coded 0 = Female and 1 = Male.
*$p < .05$; **$p < .01$

Table 10

Intercorrelations and Internal Consistencies for Supervisors (Level 2).

Scale	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. Age																	
2. Gender	.06																
3. Organizational Tenure	.61**	.20															
4. Safety Climate [a]	-.18	.36	.04														
5. Proactive Personality	-.31	-.02	-.46*	.16	.87												
6. Emotional Stability	.18	-.11	-.02	-.17	.20	.77											
7. Org. Safety Climate	-.24	.09	-.20	.06	.43*	.38*	.90										
8. Friendliness	-.15	-.17	-.17	-.15	.21	.53**	.47*	.88									
9. Gregariousness	-.02	-.17	.15	.23	.19	.41*	.19	.59**	.86								
10. Assertiveness	-.24	.06	.01	.13	.44*	.49**	.44*	.37	.32	.86							
11. Activity Level	-.11	-.04	-.15	.26	.43*	.23	.35	.52**	.54**	.55**	.78						
12. Excitement Seeking	-.36	-.21	-.24	.13	.27	.14	.29	.42*	.49**	.18	.46*	.84					
13. Cheerfulness	-.10	-.48**	-.21	-.19	.33	.44*	.42*	.76**	.44*	.37	.49**	.47*	.86				
14. Trust	-.34	-.10	-.22	.06	.35	.45*	.47*	.43*	.15	.49**	.22	.14	.36	.88			
15. Morality	-.36	-.08	-.22	-.20	.44*	.30	.13	.06	-.11	.54**	.11	.03	.15	.42*	.90		
16. Altruism	-.15	-.25	-.31	-.18	.45*	.38*	.51**	.57**	.20	.37	.36	.11	.47*	.75**	.33	.81	
17. Cooperation	-.01	-.31	.03	-.32	-.18	.03	.15	.03	-.16	-.03	-.35	-.28	.16	.45*	.04	.44*	.74
18. Modesty	-.15	-.42*	-.17	.00	.17	.13	.34	.15	-.03	.24	.19	-.14	.17	.50**	.35	.55**	.43*
19. Sympathy	.20	-.34	.01	-.30	.20	.16	.12	.20	-.01	-.08	.08	-.14	.20	.46*	.24	.67**	.38*

Table 10 (continued)

Scale	18	19
1. Age		
2. Gender		
3. Organizational Tenure		
4. Safety Climate [a]		
5. Proactive Personality		
6. Emotional Stability		
7. Org. Safety Climate		
8. Friendliness		
9. Gregariousness		
10. Assertiveness		
11. Activity Level		
12. Excitement Seeking		
13. Cheerfulness		
14. Trust		
15. Morality		
16. Altruism		
17. Cooperation		
18. Modesty	.78	
19. Sympathy	.58**	.85

Note. Cronbach's α on the diagonal. N = 28. Gender coded 0 = Female, 1 = Male.
*p < .05; **p < .01
a Aggregated safety climate score by workgroup.

Table 11

Predicting Workgroup Safety Climate with Proactive Personality and Organizational Safety Climate Perceptions: Hypothesis 1.

Variable	R^2	ΔR^2	β	F Change	Df	p
Step 1	.03	.03		.83	1, 26	ns
Emotional Stability			-.26			
Step 2	.07	.04		.55	2, 24	ns
Proactive Personality			.23			
Organizational Safety Climate			.07			
Step 3	.09	.02		.46	1, 23	ns
Proactive Personality X Organizational Safety Climate			.15			

Note. $N = 28$. Betas are for the final equation.
* $p < .10$. ** $p < .05$ one-tailed.

Table 12

Predicting Workgroup Safety Climate with Altruism, Friendliness and Cheerfulness: Hypothesis 2.

Variable	R^2	ΔR^2	β	F Change	Df	p
Step 1	.03	.03		.83	1, 26	ns
Emotional Stability			-.11			
Step 3	.06	.03		.22	3, 23	ns
Altruism			-.13			
Friendliness			.11			
Cheerfulness			-.17			

Note. $N = 28$. Betas are for the final equation.
* $p < .10$. ** $p < .05$ one-tailed.

Table 13

Predicting Workgroup Safety Climate with Agreeableness and Extraversion Traits: Research Question 1.

Variable	R^2	ΔR^2	β	F Change	Df	p
Step 1	.03	.03		.83	1,26	ns
Emotional Stability			-.34*			
Step 2	.63	.60*		1.89	12, 14	.13
Trust			.81**			
Morality			-.37*			
Altruism			.05			
Cooperation			.05			
Modesty			-.64**			
Sympathy			-.43			
Friendliness			.31			
Gregariousness			-.43*			
Assertiveness			.01			
Activity Level			-.57*			
Excitement Seeking			.45*			
Cheerfulness			.01			

Note. $N = 28$. Betas are for the final equation.
* $p < .10$. ** $p < .05$ one-tailed.

Table 14

Predicting Safety Motivation with Four Big Five Traits: Hypotheses 3 and 4.

Fixed Effect	B Coefficient	Standard Error	*t*	Df	*p**
Intercept B0	4.18	.04	104.23	27	.01
Orderliness Slope B1	.08	.07	1.17	141	.24
Cautiousness Slope B2	.21	.11	1.84	141	.07
Trust Slope B3	-.02	.08	-.20	141	.84
Altruism Slope B4	.11	.09	1.15	141	.25

Note. B coefficients calculated using robust standard errors.
* Two-tailed probability.

Table 15

Predicting Safety Motivation with Workgroup Safety Climate: Hypotheses 5.

Fixed Effect	B Coefficient	Standard Error	*t*	Df	*p**
Intercept B0	4.19	.03	123.40	26	.01
Workgroup Safety Climate G01	.23	.12	1.97	26	.06
Orderliness Slope B1	.06	.08	.81	140	.42
Cautiousness Slope B2	.23	.12	1.96	140	.05
Trust Slope B3	-.02	.08	-.22	140	.83
Altruism Slope B4	.10	.10	1.04	140	.30

Note. B coefficients calculated using robust standard errors.
* Two-tailed probability.

Table 16

Conscientiousness Traits Predicting Safety Motivation: Research Question 2.

Variable	R^2	ΔR^2	β	F Change	Df	p
Step 1	.07	.07**		4.92	2, 142	.01
Organizational Tenure			-.13			
Survey Type			.07			
Step 2	.13	.07**		11.00	1, 141	.01
Safety Climate			.25**			
Step 3	.25	.12**		3.48	6, 135	.01
Self-Efficacy			.05			
Orderliness			-.03			
Cautiousness			.21			
Dutifulness			-.07			
Achievement-Striving			.00			
Self-Discipline			.21			

Note. $N = 145$.
Betas are for the final equation.
* $p < .05$. ** $p < .01$

Table 17

Agreeableness Traits Predicting Safety Motivation: Research Question 3.

Variable	R^2	ΔR^2	β	F Change	Df	p
Step 1	.07	.07**		4.92	2, 142	.01
Organizational Tenure			-.15			
Survey Type			.09			
Step 2	.13	.07**		11.00	1, 141	.01
Safety Climate			.23**			
Step 3	.22	.09*		2.60	6, 135	.02
Trust			.01			
Morality			.26**			
Altruism			.00			
Cooperation			-.01			
Modesty			.07			
Sympathy			.07			

Note. $N = 145$.
Betas are for the final equation.
* $p < .05$. ** $p < .01$

Table 18

Agreeableness and Conscientious Factors Predicting Safety Motivation.

Variable	R^2	ΔR^2	β	F Change	Df	p
Step 1	.05	.05**		8.08	1, 143	.01
Organizational Tenure			-.13			
Step 2	.12	.07**		10.77	1, 142	.01
Safety Climate			.20**			
Step 3	.22	.10**		9.27	2, 140	.01
Agreeableness			.12			
Conscientiousness			.27**			

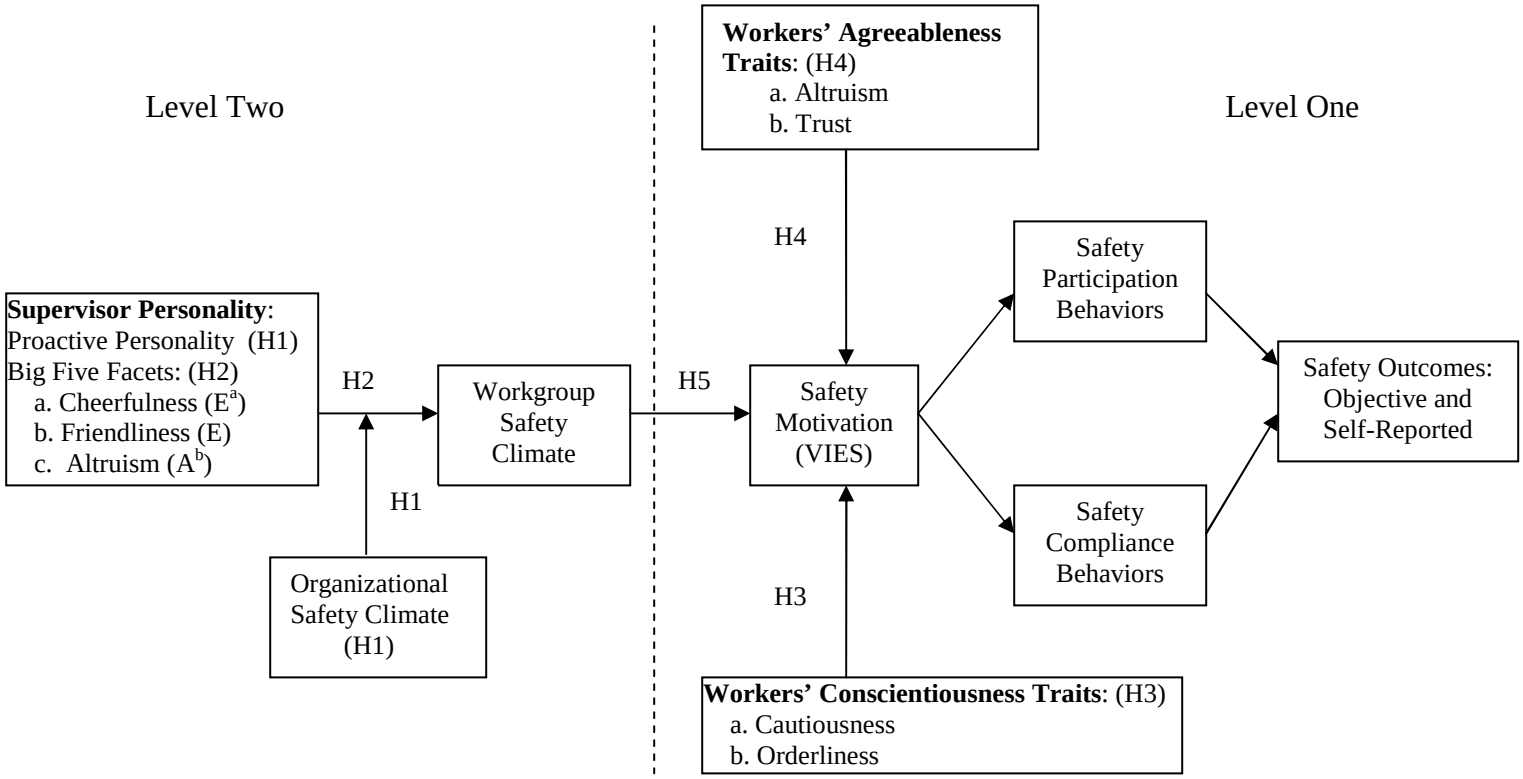
Note. $N = 145$

Betas are from individual equations.

* $p < .05$. ** $p < .01$

Figure 1

Multilevel Model of Hypothesized Relationships.



Note. a) E-extraversion; b) A-agreeableness

Figure 2

A Multilevel Safety Climate Model from Zohar (2003a).

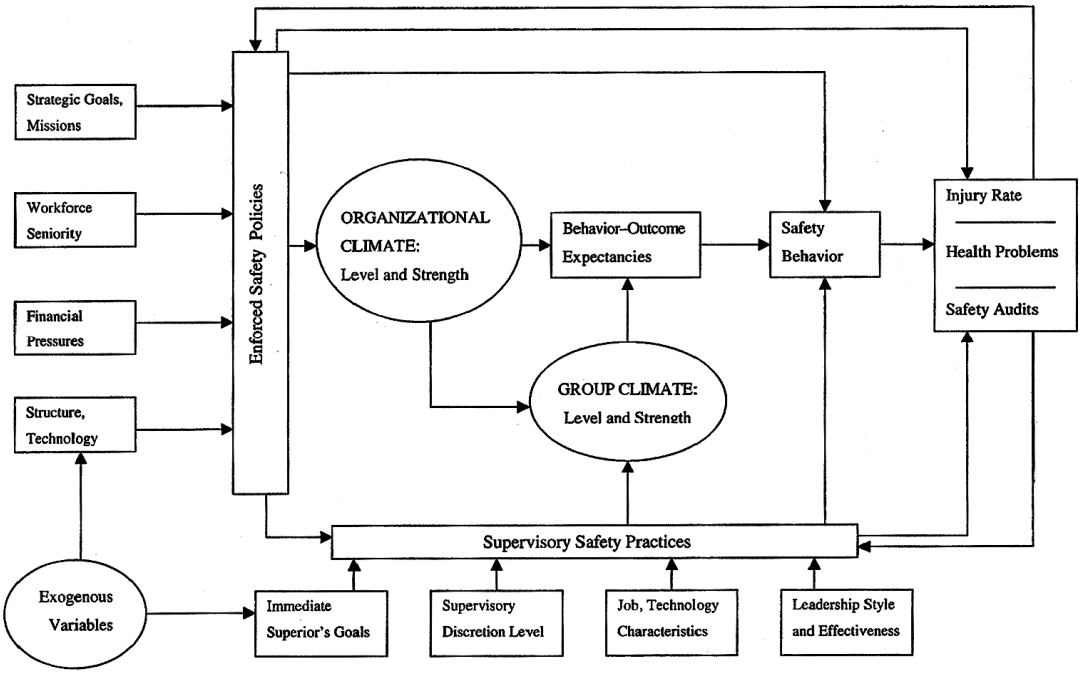


Figure 3

Neal & Griffin (2004) Framework for Conceptualizing Safety Climate and Safety Behavior.

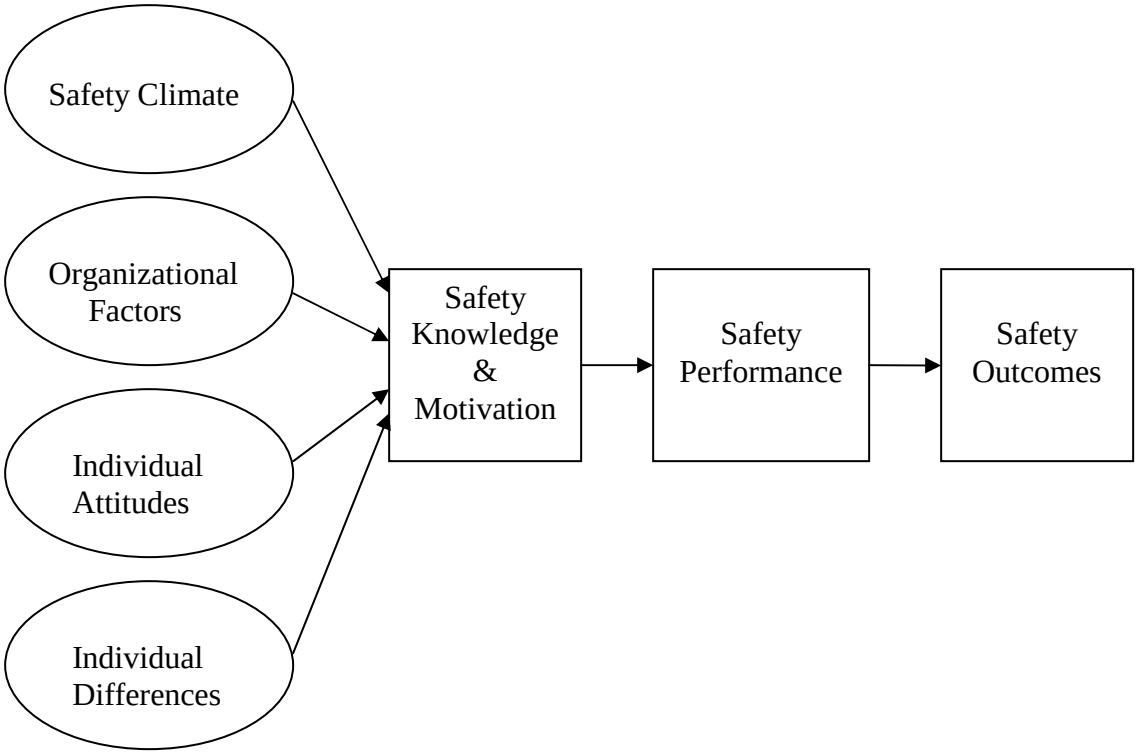


Figure 4

Path Model from Griffin & Neal (2000) Study 1.

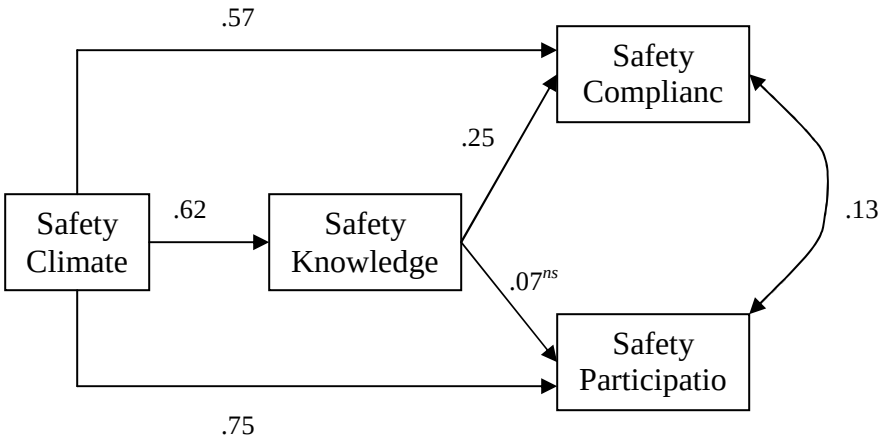


Figure 5

Path Model from Griffin & Neal (2000) Study 2.

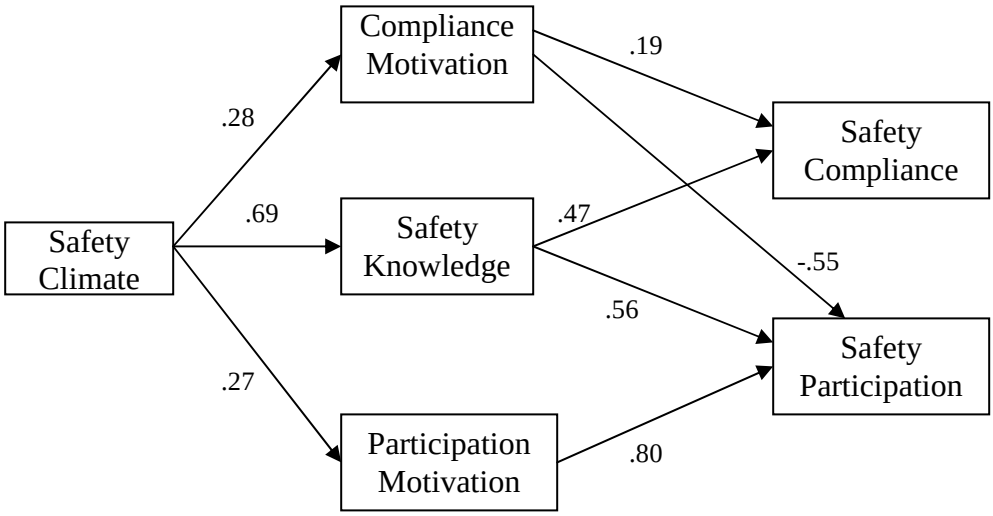


Figure 6

Path Model from Neal, Griffin, & Hart (2000).

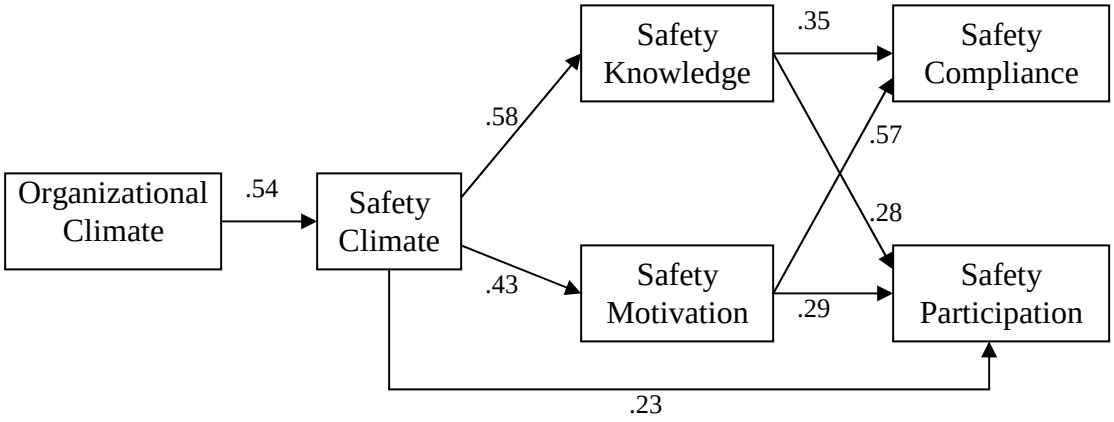


Figure 7

Organizational Safety Climate as a Moderator.

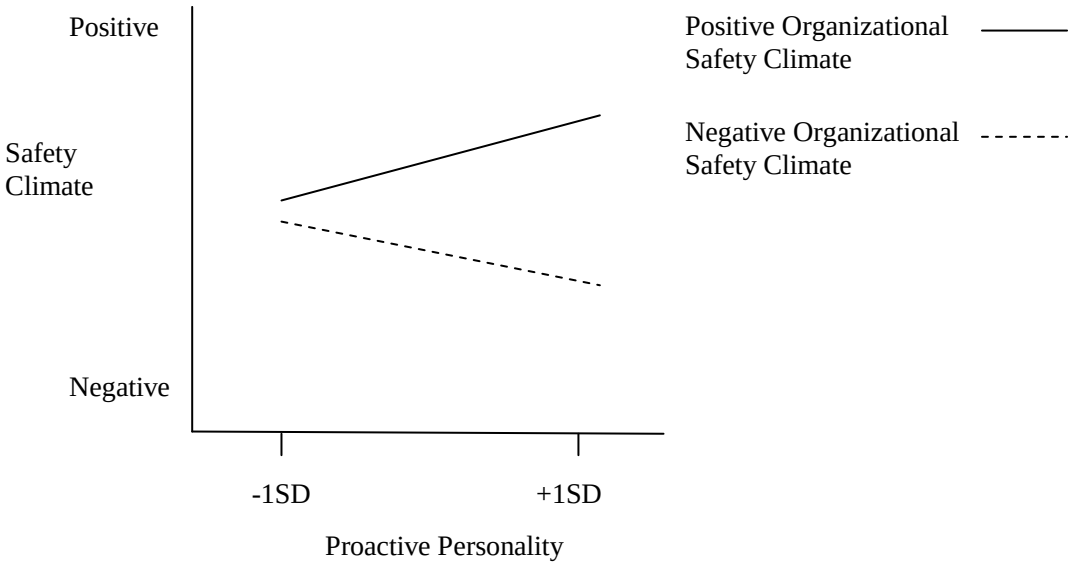


Figure 8

Basic Level 1 Path Model.

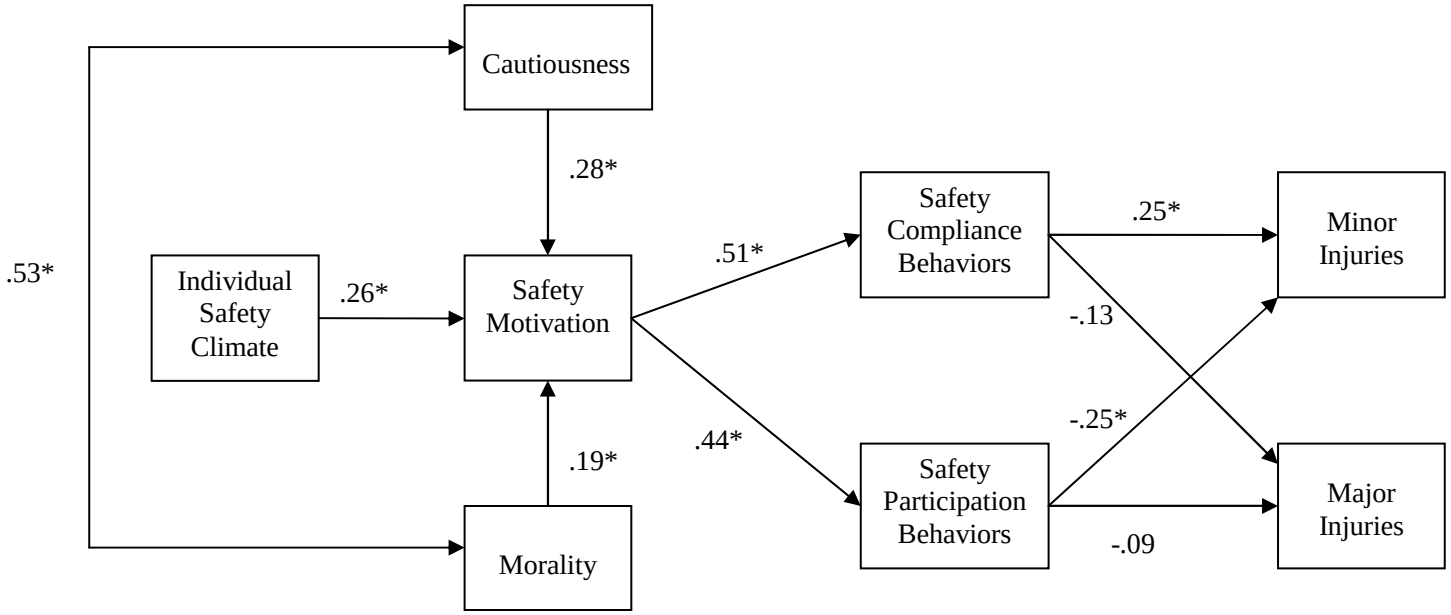


Figure 9

Level 1 Mediation Model.

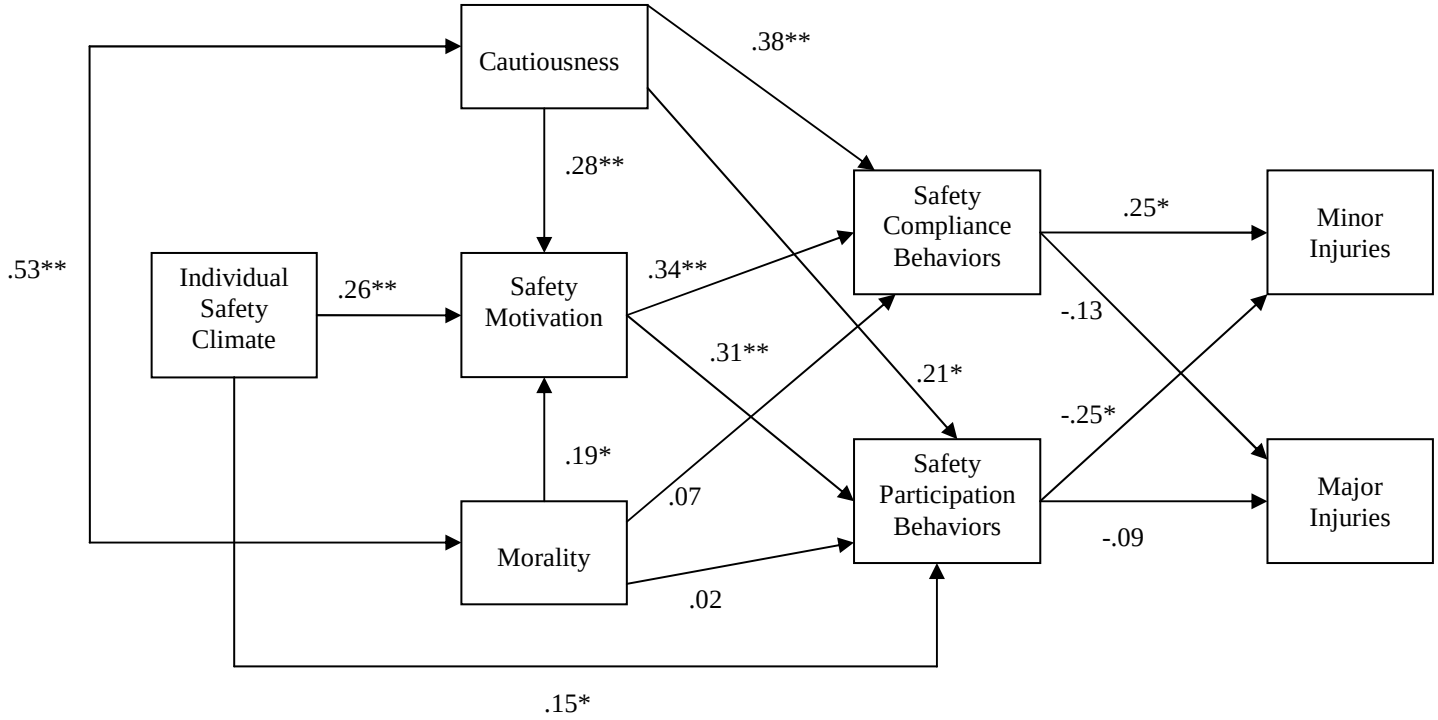
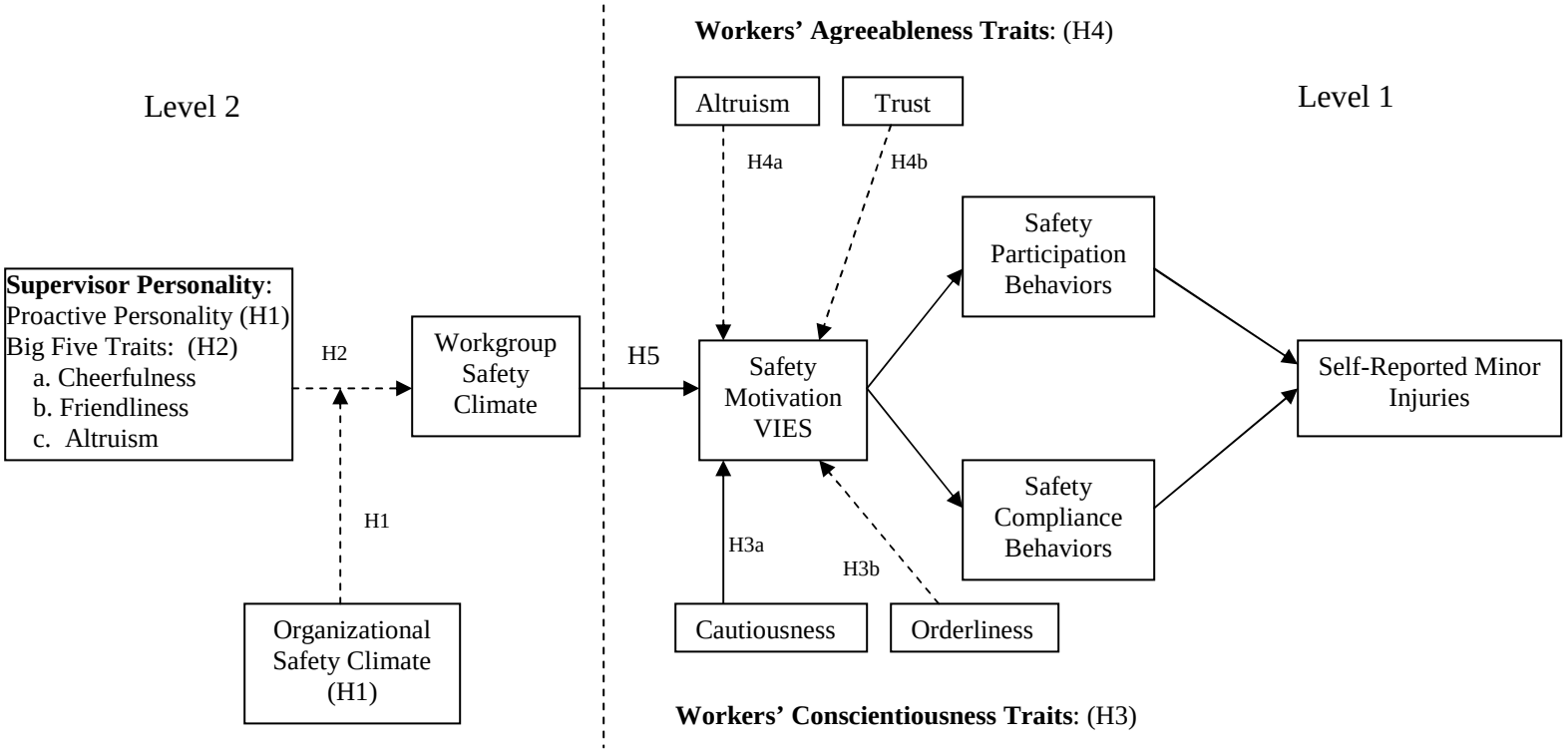


Figure 10

Study Model Showing Results of Hypothesis Tests.



Note. Solid lines represent supported hypotheses and significant relationships. Dashed lines with arrowheads represent unsupported hypotheses.

References

Abdel-Aty, M.A., & Radwan, A.E. (2000). Modeling traffic accident occurrence and involvement. *Accident Analysis and Prevention, 32*¸ 633-642.

Allen, N.J., & Meyer, J.P. (1990). The measurement and antecedents of affective, continuance, and normative commitment to the organization. *Journal of Occupational Psychology, 63*, 1-18.

Alliger, G.M., & Williams, K.J. (1993). Using signal-contingent experience sampling methodology to sample work in the field. *Personnel Psychology, 46*, 525-549.

Amason, A.C. (1996). Distinguishing the effects of functional and dysfunctional conflict on strategic decision making: Resolving a paradox for top management teams. *Academy of Management Journal, 39*, 123-148.

Arthur, W., Jr., Barrett, G.V., & Alexander, R.A. (1991). Prediction of vehicular accident involvement: A meta-analysis. *Human Performance, 4*, 89-105.

Arthur, W., Jr., & Graziano, W.G. (1996). The five-factor model, conscientiousness, and driving accident involvement. *Journal of Personality, 64*, 593-618.

Ashton, M. (1998). Personality and job performance: The importance of narrow traits. *Journal of Organizational Behavior, 19*, 289-303.

Ashton, M.C., Jackson, D.N., Paunonen, S.C., Helmes, E., & Rothstein, M.G. (1995). The criterion validity of broad factor scales versus specific facet scales. *Journal of Research in Personality, 29*, 432-442.

Austin, J., Kessler, M.L., Riccobono, J.E., & Bailey, J.S. (1996). Using feedback and reinforcement to improve the safety of a roofing crew. *Journal of Organizational Behavior Management, 16,* 49-75.

Bandura, A. (1986). *Social foundations of thought and action: A social-cognitive theory.* Englewood Cliffs, NJ: Prentice-Hall.

Barling, J., & Frone, M.R. (2004). Occupational injuries: Setting the stage. In J. Barling & M.R. Frone (Eds.), *The psychology of workplace safety* (pp. 3-12). Washington, D.C.: American Psychological Association.

Barling, J., & Hutchinson, I. (2000). Commitment vs. control-based safety practices, safety reputation, and perceived safety climate. *Canadian Journal of Administrative Sciences, 17,* 76-84.

Barling, J., Loughlin, C., & Kelloway, E.K. (2002). Development and test of a model linking safety-specific transformational leadership and occupational safety. *Journal of Applied Psychology, 87,* 488-496.

Baron, R.M., & Kenny, D.A. (1986). The moderator—mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51,* 1173-1182.

Barrick, M.R., & Mount, M.K. (1991). The Big Fiver personality dimensions and job performance: A meta-analysis. *Personnel Psychology, 44,* 1-26.

Barrick, M.R., & Mount, M.K. (1995). The Big Five personality dimensions: Implications for research and practice in human resources management. *Research in Personnel and Human Resources Management, 13,* 153-200.

Barrick, M.R., Stewart, G.L., & Piotrowski, M. (2002). Personality and job performance: Test of the mediating effects of motivation among sales representatives. *Journal of Applied Psychology*, *87*, 43-51.

Bass, B.M. (1998). *Transformational leadership: Industry, military and educational impacts*. Mahwah, NJ: Erlbaum.

Bateman, T.S., & Crant, J.M. (1993). The proactive component of organizational behavior: A measure and correlates. *Journal of Organizational Behavior*, *14*, 103-118.

Bauer, T.N., & Green, S.G. (1996). Development of leader-member exchange: A longitudinal test. *Academy of Management Journal*, *39*, 1538-1567.

Beus, J.M., Payne, S.C., Bergman, M.E., & Arthur, W. Jr. (2010). Safety climate and injuries: An examination of theoretical and empirical relationships. *Journal of Applied Psychology, 95,* 713-727.

Blaylock, H.M., Jr. (1972). *Social statistics*. (2nd Ed.). NY: McGraw-Hill.

Bliese, P.D. (2000). Within-group agreement, non-independence, and reliability: Implications for data aggregation and analysis. In K.J. Klein & S.W.J. Kozlowski (Eds.), *Multilevel theory, research, and methods in organizations* (pp. 349-381). San Francisco: Jossey-Bass.

Blau, P. (1964). *Exchange and power in social life*. NY: Wiley.

Borenstein, M. (2001). Power and Precision (Release 2.1) [Computer software]. Engelwood, NJ: Biostat.

Borman, W.C., & Motowidlo, S.J. (1993). Expanding the criterion domain to include elements of contextual performance. In N.Schmitt & W.C. Borman (Eds.), *Personnel selection in organizations* (pp. 71-98). San Francisco: Jossey-Bass.

Broadbent, D.E., Cooper, P.F., Fitzgerald, P., & Parkes, K.R. (1982). The Cognitive Failures Questionnaire (CFQ) and its correlates. *British Journal of Clinical Psychology, 21*, 1-16.

Brown, R.L., & Holmes, H. (1986). The use of a factor-analytic procedure for assessing the validity of an employee safety climate model. *Accident Analysis & Prevention, 18*, 455-470.

Bryk, A.S., & Raudenbush, S.W. (1992). *Hierarchical linear models*. Thousand Oaks, CA: Sage.

Bureau of Labor Statistics. (2010). *Injuries, illnesses, and fatalities in 2009.* Retrieved December 7, 2010 from http://www.bls.gov/iif.

Burke, M.J., Sarpy, S.A., Tesluk, P.E., & Smith-Crowe, K. (2002). General safety performance: A test of a grounded theoretical model. *Personnel Psychology*, *55*, 429-457.

Cascio, W.F., and Zedeck, S. (1983). Open a new window into rational research planning: Adjust alpha to maximize statistical power. *Personnel Psychology*, *36*, 517-526.

Cattell, R.B., Eber, H.W., & Tatsuoka, M.M. (1980). *Handbook for the Sixteen Personality Factor Questionnaire (16PF)*. Champaign, IL: Institute for Personality and Ability testing (IPAT).

Cellar, D.F., Nelson, Z.C., & Yorke, C.M. (2001). The five-factor model and safety in the workplace: Investigating the relationships between personality and accident involvement. *Journal of Prevention and Intervention in the Community*, *22*, 43-52.

Chen, C. (2009). Personality, safety attitudes, and risk driving behaviors—Evidence from young Taiwanese motorcyclists. *Accident Analysis and Prevention*, *41*, 963-968.

Cheyne, A., Cox, S., Oliver, A., & Tomas, J.M. (1998). Modeling safety climate in the prediction of levels of safety activity. *Work & Stress*, *12,* 255-271.

Cheyne, A., Oliver, A., Tomas, J.M., & Cox, S. (2002). The architecture of employee attitudes to safety in the manufacturing sector. *Personnel Review*, *31,* 649-670.

Christian, M.S., Bradley, J.C., Wallace, J.C., & Burke, M.J. (2009). Workplace safety: A meta-analysis of the roles of person and situational factors. *Journal of Applied Psychology*, *94,* 1103-1127.

Clarke, S. (2006a). The relationship between safety climate and safety performance: A meta-analytic review. *Journal of Occupational Health Psychology*, *11*, 315-327.

Clarke, S. (2006b). Safety climate in an automobile manufacturing plant: The effects of work environment, job communication and safety attitudes on accidents and unsafe behavior. *Personnel Review*, *35*, 413-430.

Clarke, S., & Robertson, I.T. (2005). A meta-analytic review of Big Five personality factors and accident involvement in occupational and non-occupational settings. *Journal of Occupational and Organizational Psychology*, *78*, 355-376.

Clarke, S., & Robertson, I.T. (2008). An examination of the role of personality in work accidents using meta-analysis. *Applied Psychology: An International Review*, *57*, 94-108.

Clarke, S., & Ward, K. (2006). The role of leader influence tactics and safety climate in engaging employees' safety participation. *Risk Analysis, 26,* 1175-1185.

Cohen, A., & Margolis, B. (1973). Initial psychological research related to the Occupational Safety and Health Act of 1970. *American Psychologist, 28,* 600-606.

Conchie, S.M., & Burns, C. (2009). Improving occupational safety: Using a trusted information source to communicate about risk. *Journal of Risk Research, 12,* 13-25.

Conchie, S.M., & Donald, I.J. (2009). The moderating role of safety-specific trust on the relation between safety-specific leadership and safety citizenship behaviors. *Journal of Occupational Health Psychology*, *14*, 137-147.

Cooper, M.D., & Phillips, R.A. (2004). Exploratory analysis of the safety climate and safety behavior relationship. *Journal of Safety Research*, *35*, 497-512.

Cooper, M.D., Phillips, R.A., Sutherland, V.J., & Makin, P.J. (1994). Reducing accidents using goal setting and feedback: A field study. *Journal of Occupational and Organizational Psychology*, *67*, 219-240.

Cox, S., & Cox, T. (1996). *Safety, systems and people*. Oxford: Butterworth-Heinemann.

Cox, S., & Flin, R. (1998). Safety culture: Philosopher's stone or man of straw? *Work & Stress, 12*, 189-201.

Coyle, I.R., Sleeman, S.D., & Adams, N. (1995). Safety climate. *Journal of Safety Research, 26*, 247-254.

Crant, J.M. (1995). The proactive personality scale and objective job performance among real estate agents. *Journal of Applied Psychology, 80*, 532-537.

Crant, J.M., & Bateman, T.S. (2000). Charismatic leadership viewed from above: The impact of proactive personality. *Journal of Organizational Behavior, 21*, 63-75.

Cree, T., & Kelloway, E.K. (1997). Responses to occupational hazards: Ext and participation. *Journal of Occupational Health Psychology*, *2*, 304-311.

Cronbach, L.J., & Glesser, G.C. (1965). *Psychological tests and personnel decisions*, 2nd. Ed. Urbana, IL: University of Illinois Press.

Dahlen, E.R., Martin, R.C., Ragan, K., & Kuhlman, M.M. (2005). Driving anger, sensation seeking, impulsiveness, and boredom proneness in the prediction of unsafe driving. *Accident Analysis and Prevention*, *37*, 341-348.

Dedobbeleer, N., & Beland, F. (1991). A safety climate measure for construction sites. *Journal of Safety Research, 22*, 97-103.

De Dreu, C.K.W., & Weingart, L.R. (2003). Task versus relationship conflict, team performance, and team-member satisfaction: A meta-analysis. *Journal of Applied Psychology, 88,* 741-479.

DeJoy, D.M., Schaffer, B.S., Wilson, M.G., Vandenberg, R.J., & Butts, M.M. (2004). Creating safer workplaces: Assessing the determinants and role of safety climate. *Journal of Safety Research, 35*, 81-90.

Dekker, S.W.A. (2002). Reconstructing human contributions to accidents: The new view on error and performance. *Journal of Safety Research, 33,* 371-385.

Den Hartog, D.N., & Koopman, P.L. (2001). Leadership in organizations. In N. Anderson, D. S. Ones, H. K. Sinagil, & C. Viswevaran (Eds.), *Handbook of industrial, work, and organizational psychology, Vol. 2,* (pp. 166-187).

Denison, D. (1996). What is the difference between organizational culture and climate? *Academy of Management Review, 21*, 619-654.

Diaz, R.I., & Cabrera, D.D. (1997). Safety climate and attitude as evaluation measures of organizational safety. *Accident Analysis & Prevention, 29,* 643-650.

Dudley, N.M., Orvis, K.A., Lebiecki, J.E., & Cortina, J.M. (2006). A meta-analytic investigation of conscientiousness in the prediction of job performance: Examining the intercorrelations and the incremental validity of narrow traits. *Journal of Applied Psychology, 91,* 40-57.

Eisenberger, R., Huntington, R., Hutchison, S., & Sowa, D. (1986). Perceived organizational support. *Journal of Applied Psychology, 71*, 500-507.

Engle, E.M., & Lord, R.M. (1997). Implicit theories, self-schemas, and leader-member exchange. *Academy of Management Journal, 40*, 988-1010.

Eysenck, H.J., & Eysenck, S.B.G. (1975). *Manual of the Eysenck Personality Questionnaire*. London: Hodder & Stoughton.

Finkelstein, L.M., Kulas, J.T., & Dages, K.D. (2003). Age differences in proactive newcomer socialization strategies in two populations. *Journal of Business and Psychology, 17*, 473-502.

Flin, R., Mearns, K., O'Connor, P., & Bryden, R. (2000). Measuring safety climate: Identifying the common features. *Safety Science, 34*, 177-192.

Fogarty, G.J. (2005). Psychological strain mediates the impact of safety climate on maintenance errors. *International Journal of Applied Aviation Studies, 5*, 53-63.

Friedman, M., & Rosenman, R.H. (1974). *Type A behavior and your heart*. NY: Knopf.

Fullerton, C., & Stokes, M. (2007). The utility of a workplace injury instrument in prediction or workplace injury. *Accident Analysis & Prevention, 39*, 28-37.

Gaba, D.M., Singer, S.J., Sinaiko, A.D., Bowen, J.D., & Ciaverelli, A.P. (2003). Differences in safety climate between hospital personnel and naval aviators. *Human Factors, 45*, 173-185.

Game, A.M. (2007). Workplace boredom coping: Health, safety, and HR implications. *Personnel Review*, *36*, 701-721.

Ganster, D.C., Schaubroeck, J., Sime, W.E., & Mayes, B.T. (1990). Unhealthy leader dispositions, work group strain and performance. *Academy of Management Best Papers Proceedings*: 191-195.

Gatewood, R.D., Feild, H.S., & Barrick, M.R. (2007). *Human resource selection*, (6th Ed.). NY: Harcourt, Inc.

George, J.M. (1989). Mood and absence. *Journal of Applied Psychology*, *74*, 317-324.

George, J.M. (1991). State or trait: Effects of positive mood on prosocial behaviors at work. *Journal of Applied Psychology*, *76*, 299-307.

George, J.M. (1992). The role of personality in organizational life: Issues and evidence. *Journal of Management, 18,* 185-213.

George, J.M., & Bettenhausen, K. (1990). Understanding prosocial behavior, sales performance, and turnover: A group-level analysis in a service context. *Journal of Applied Psychology, 75,* 698-709.

George, J.M., & Brief, A.P. (1992). Feeling good-doing good: A conceptual analysis of the mood at work-organizational spontaneity relationship. *Psychological Bulletin*, *112*, 310-329.

Gershon, R.R.M., Karkashian, C.D., Vlahov, D., Kummer, L., Kasting, C., Green-McKenzie, J., Escamilla-Cejudo, J.A., Kendig, N., Swetz, A., & Martin, L.

(1998). Compliance with universal precautions in correctional health care facilities. *Journal of Occupational and Environmental Medicine, 41*, 181-189.

Gillen, M., Baltz, D., Gassel, M., Kirsch, L., & Vaccaro, D. (2002). Perceived safety climate, job demands, and coworker support among union and nonunion injured construction workers. *Journal of Safety Research, 33,* 33-51.

Gillen, M., Faucett, J., Beaumont, J.J., & McLaughlin, E. (1997). Injury severity associated with nonfatal construction falls. *American Journal of Industrial Medicine, 32,* 647-655.

Glendon, A.I., & Litherland, D.K. (2001). Safety climate factors, group differences and safety behaviour in road construction. *Safety Science, 39,* 157-188.

Goldberg, L.R. (1992). The development of markers for the Big-Five factor structure. *Psychological Assessment, 4,* 26-42.

Goldberg, L.R. (1993). The structure of phenotypic personality traits. *American Psychologists, 48,* 26-34.

Goldberg, L.R. (1999). A broad-bandwidth, public domain, personality inventory measuring the lower-level facets of several five-factor models. In I. Mervielde, I. Deary, F. De Fruyt, & F. Ostendorf (Eds.), *Personality Psychology in Europe,* Vol. 7 (pp. 7-28). Tilburg, The Netherlands: Tilburg University Press.

Goldenhar, L.M., Williams, L.J., & Swanson, N.G. (2003). Modeling relationships between job stressors and injury and near-miss outcomes for construction labourers. *Work & Stress, 17,* 218-240.

Gouldner, A.W. (1960). The norm of reciprocity. *American Sociological Review*, *25*, 165-167.

Greenwood, M., & Woods, H.M. (1919). A report on the incidence of industrial accidents upon individuals with special reference to multiple accidents. Reproduced in W. Haddon, E.A. Suchman, & D. Klein (Eds.), *Accident research*. NY: Harper & Row.

Graen, G.B. (2007). Asking the wrong questions about leadership. *American Psychologist*, *62*, 604-605.

Graen, G.B., & Uhl-Bien, M. (1995). Relationship-based approach to leadership: Development of leader-member exchange (LMX) theory of leadership over 25 years: Applying a multi-level multi-domain perspective. *Leadership Quarterly*, *6*, 219-247.

Grant, A.D., Parker, S., & Collins, C. (2009). Getting credit for proactive behavior: Supervisor reactions depend on what you value and how you feel. *Personnel Psychology*, *62*, 31-55.

Griffin, M.A., & Neal, A. (2000). Perceptions of safety at work: A framework for linking safety climate to safety performance, knowledge, and motivation. *Journal of Occupational Health Psychology*, *5*, 347-358.

Gyekye, S.A., & Salimen, S. (2005). Are “good soldiers” safety conscious? An examination of the relationship between organizational citizenship behaviors and perception of workplace safety. *Social Behavior and Personality*, *33*, 805-820.

Hansen, C.P. (1988). Personality characteristics of the accident involved employee. *Journal of Business and Psychology*, *2*, 346-365.

Hansen, C.P. (1989). A causal model of the relationship among accidents, biodata, personality and cognitive factors. *Journal of Applied Psychology*, *74*, 81-90.

Harvey, S., Blouin, C., & Stout, D. (2006). Proactive personality as a moderator of outcomes for young workers experiencing conflict at work. *Personality and Individual Differences*, *40*, 1063-1074.

Havold, J.I. (2005). Safety-culture in a Norwegian shipping company. *Journal of Safety Research, 36*, 441-458.

Hofmann, D.A., Griffin, M.A., & Gavin, M.B. (2000). The application of hierarchical linear modeling to organizational research. In K.J. Klein & S.W.J. Kozlowski (Eds.), *Multilevel theory, research, and methods in organizations* (pp. 467-511). San Francisco, CA: Jossey-Bass.

Hofmann, D.A., Jacobs, R.R., & Landy, F. (1995). High reliability process industries: Individual, micro, and macro organizational influences on safety performance. *Journal of Safety Research*, *26*¸131-149.

Hofmann, D.A., & Mark, B. (2006). An investigation of the relationship between safety climate and medication errors as well as other nurse and patient outcomes. *Personnel Psychology*, *59*, 847-869.

Hofmann, D.A., & Morgeson, F.P. (1999). Safety-related behavior as a social exchange: The role of perceived organizational support and leader-member exchange. *Journal of Applied Psychology*, *84*, 286-296.

Hofmann, D.A., Morgeson, F.P., & Gerras, S.J. (2003). Climate as a moderator of the relationship between leader-member exchange and content specific citizenship: Safety climate as an exemplar. *Journal of Applied Psychology, 88*, 170-178.

Hofmann, D.A., & Stetzer, A. (1996). A cross-level investigation of factors influencing unsafe behaviors and accidents. *Personnel Psychology, 49*, 307-339.

Hofmann, D.A., & Stetzer, A. (1998). The role of safety climate and communication in accident interpretation: Implications for learning from negative events. *Academy of Management Journal, 41*, 644-657.

Hogan, J., & Holland, B. (2003). Using theory to evaluate personality and job-performance relations: A socioanalytic perspective. *Journal of Applied Psychology, 88*, 100-112.

Hogan, J., & Roberts, B.W. (1996). Issues and non-issues in the fidelity–bandwidth trade-off. *Journal of Organizational Behavior, 17*, 627-637.

Hough, L. (1992). The "Big Five" personality variables–construct confusion: Description versus prediction. *Human Performance, 5*, 139-155.

Hough, L.M., & Schneider, R.J. (1996). Personality traits, taxonomies, and applications in organizations. In K.R. Murphy (Ed.), *Individual differences and behavior in organizations* (pp. 31-88). SF: Jossey-Bass.

Houston, D. (1989). The relationship between cognitive failure and self-focused attention. *British Journal of Clinical Psychology, 28*, 85-86.

Howell, D.C. (2002). *Statistical methods for psychology* (5th Ed.). Pacific Grove, CA: Duxbury.

Huang, Y.H., Chen, P.Y., Krauss, A.D., & Rodgers, D.A. (2004). Quality of the execution of corporate safety policies and employee safety outcomes: Assessing the moderating role of supervisor safety support and the mediating role of employee safety control. *Journal of Business and Psychology, 18*, 483-506.

Huang, Y.H., Ho, M., Smith, G.S., & Chen, P.Y. (2006). Safety climate and self-reported injury: Assessing the mediating role of employee safety control. *Accident Analysis & Prevention, 38,* 425-433.

Huang, Y.H., Shaw, W.S., & Chen, P.Y. (2004). Worker perceptions of organizational support and return-to-work policy: Associations with post-injury job satisfaction. *Work, 23,* 225-232.

Iverson, R.D., & Erwin, P.J. (1997). Predicting occupational injury: The role of affectivity. *Journal of Occupational and Organizational Psychology, 70*, 113-128.

Jackson, D.N. (1970). *Jackson personality inventory*. Port Huron, MI: Sigma Assessment Systems.

James, L.R., Demaree, R.J., & Wolf, G. (1984). Estimating within-group interrater reliability with and without response bias. *Journal of Applied Psychology, 69,* 85-98.

James, L.R., Demaree, R.J., & Wolf, G. (1993). r_{wg}: An assessment of within-group interrater agreement. *Journal of Applied Psychology, 78*, 306-309.

Janssens, M., Brett, J.M., & Smith, F.J. (1995). Confirmatory cross-cultural research: Testing the viability of a corporation-wide safety policy. *Academy of Management Journal, 38*, 364-382.

Jex, S.M., & Beehr, T.A. (1991). Emerging theoretical and methodological issues in the study of work stress. *Research in Personnel and Human Resources Management, 9*, 311-365.

Johnson, S.E. (2007). The predictive validity of safety climate. *Journal of Safety Research, 38*, 511-521.

Jones, J.W., & Wuebker, L. (1985). Development and validation of the Safety Locus of Control (SLC) Scale. *Perceptual and Motor Skills, 61*, 151-161.

Judge, T.A. (1993). Does affective disposition moderate the relationship between job satisfaction and voluntary turnover? *Journal of Applied Psychology, 78*, 395-401.

Kaminski, M. (2001). Unintended consequences: Organizational practices and their impact on workplace safety and productivity. *Journal of Occupational Health Psychology, 6*, 127-138.

Kanfer, R., & Ackerman, P.L. (1989). Motivation and cognitive abilities: An integrative/aptitude-treatment interaction approach to skill acquisition. *Journal of Applied Psychology, 74*, 657-690.

Karasek, R. (1979). Job demands, job decision latitude, and mental strain: Implications for job redesign. *Administrative Science Quarterly*, *24*, 285-306.

Karson, S., & O'Dell, J.W. (1974). Personality differences between male and female air traffic controller applicants. *Aerospace Medicine*, *45*, 596-598.

Katz-Navon, T., Naveh, E., & Stern, Z. (2005). Safety climate in health care organizations: A multidimensional approach. *Academy of Management Journal*, *48*, 1075-1089.

Kelloway, E.K., Mullen, J., & Francis, L. (2006). Divergent effects of transformational and passive leadership on employee safety. *Journal of Occupational Health Psychology*, *11*, 76-86.

Kilpatrick, S.A., & Locke, E.A. (1991). Leadership: Do traits matter? *Academy of Management Executive*, *5*, 48-60.

Kines, P., Andersen, L.P.S., Spangenberg, S., Mikkelsen, K.L., Dyreborg, J., & Zohar, D. (2010). Improving construction site safety through leader-based safety communication. *Journal of Safety Research*, *41*, 399-406.

Klein, K.J., Dansereau, F., & Hall, R.J. (1994). Levels issues in theory development, data collection, and analysis. *Academy of Management Review*, *19*, 195-229.

Klein, K.J., & Kozlowski, S.W.J. (2000). *Multilevel theory, research, and methods in organizations*. San Francisco, CA: Jossey-Bass.

Kozlowski, S.W.J., & Klein, K.J. (2000). A multilevel approach to theory and research in organizations: Contextual, temporal, and emergent processes. In K.J. Klein

& S.W.J. Kozlowski (Eds.), *Multilevel theory, research, and methods in organizations* (pp. 3-90). San Francisco, CA: Jossey-Bass.

Landy, F.J., & Conte, J.M. (2004). *Work in the 21st century*. Boston, MA: McGraw-Hill.

Lajunen, T. (2001). Personality and accident liability: Are extraversion, neuroticism and psychoticism related to traffic and occupational fatalities? *Personality and Individual Differences*, *31*, 1365-1373.

Lardent, C.L., Jr. (1991). Pilots who crash: Personality constructs underlying accident prone behavior of fighter pilots. *Multivariate Experimental Clinical Research, 10*, 1-25.

Larson, G.E., Alderton, D.L., Neideffer, M., & Underhill, E. (1997). Further evidence on dimensionality and correlates of the Cognitive Failures Questionnaire. *British Journal of Psychology, 88*, 29-38.

Larson, G.E., & Merritt, C.R. (1991). Can accidents be predicted? An empirical test of the Cognitive Failures Questionnaire. *Applied Psychology: An International Review*, *40*, 37-45.

Larsson, S., Pousette, A., & Torner, M. (2008). Psychological climate and safety in the construction industry-mediated influence on safety behaviour. *Safety Science, 46*, 405-412.

Lee, T., & Harrison, K. (2000). Assessing safety culture in nuclear power stations. *Safety Science*, *34*, 61-97.

Lenth, R.V. (2009). Java applets for power and sample size [computer program]. Retrieved August 13, 2010 from http://www.stat.uiowa.edu/~rlenth/Power.

Lester, D. (2000). National differences in neuroticism and extraversion. *Personality and Individual Differences, 28,* 35-39.

Levin, I., & Stokes, J.P. (1989). Dispositional approach to job satisfaction: Role of negative affectivity. *Journal of Applied Psychology, 74,* 752-758.

Liao, H., Arvey, R. D., Butler, R. J., & Nutting, S. M. (2001). Correlates of work injury frequency and duration among firefighters. *Journal of Occupational Health Psychology, 6,* 229-242.

Liberty Mutual Research Institute for Safety. (2008). Workplace safety index. *From Research to Reality, Winter,* 1-12.

Liden, R. C., & Maslen, J. M. (1998). Multidimensionality of the leader-member exchange: an empirical assessment through scale development. *Journal of Management, 24(1),* 43-72.

Lingard, H. (2002). The effect of first aid training on Australian construction workers' occupational health and safety motivation and risk control behavior. *Journal of Safety Research, 33,* 209-230.

Locke, E.A., & Latham, G.P. (2002). Building a practically useful theory of goal setting and task motivation: A 35-year odyssey. *American Psychologist, 57,* 705-717.

Lord, R.G., De Vader, C.L., & Allinger, G.M. (1986). A meta-analysis of the relationship between personality traits and leader perceptions: An application

of validity generalization procedures. *Journal of Applied Psychology*, *71*, 402-410.

Loughlin, C., & Frone, M. R. (2004). Young workers' occupational safety. In J. Barling, & M. R. Frone (Eds.), *The psychology of workplace safety, (pp. 107-126).* Washington, DC: American Psychological Association.

Lu, C.S., & Shang, K.C. (2005). An empirical investigation of safety climate in terminal operators. *Journal of Safety Research*, *36*, 297-308.

Luria, G. (2008). Climate strength—how leaders form consensus. *The Leadership Quarterly*, *19*, 42-53.

Luria, G. (2010). The social aspects of safety management: Trust and safety climate. *Accident Analysis and Prevention*, *42*, 1288-1295.

Luria, G., Zohar, D., & Erev, I. (2008). The effect of workers' visibility on effectiveness of intervention programs: Supervisory-based safety interventions. *Journal of Safety Research*, *39*, 273-280.

Lynn, R., & Hampson, S.L. (1975). National differences in extraversion and neuroticism. *British Journal of Social and Clinical Psychology*, *14*, 223-240.

Maierhofer, N.I., Griffin, M.A., & Sheehan, M. (2000). Linking manager values and behavior with employee values and behavior: A study of values and safety in the hairdressing industry. *Journal of Occupational Health Psychology*, *5*, 417-427.

Major, D.A., Turner, J.E., & Fletcher, T.D. (2006). Linking proactive personality and the Big Five to motivation to learn and developmental activity. *Journal of Applied Psychology*, *91*, 927-935.

Martin, M. (1983). Cognitive failure: Everyday and laboratory performance. *Bulletin of the Psychonomic Society*, *21*, 97-100.

Mattila, M., Rantanen, E., & Hytinnen, M. (1994). The quality of work environment, supervision and safety in building construction. *Safety Science*, *17*, 257-268.

Mayer, R.E., & Treat, J.R. (1977). Psychological, social, and cognitive characteristics of high-risk drivers: A pilot study. *Accident Analysis and Prevention*, *9*, 1-8.

McCrae, R.R., & Costa, P.T., Jr. (1987). Validation of the five-factor model of personality across instruments and observers. *Journal of Personality and Social Psychology*, *52*, 81-90.

McCrae, R.R., & Costa, P.T. (1992). Discriminant validity of NEO-PIR facet scales. *Education and Psychological Measurement*, *52*, 229-237.

McGovern, P.M., Vesley, D., Kochevar, L., Gershon, R.R.M., Rhame, F.S., & Anderson, E. (2000). Factors affecting universal precautions compliance. *Journal of Business and Psychology*, *15*, 149-161.

McKenna, F.P. (1983). Accident proneness: A conceptual analysis. *Accident Analysis and Prevention*, *15*, 65-71.

Mearns, K.J., & Flin, R. (2001). Assessing the state of organizational safety–Culture or climate? In H. Ellis & N. Macrae (Eds.), *Validation in psychology*, (pp. 5-20). New Brunswick, N.J.: Transaction Publishers.

Mearns, K., Flin, R., Gordon, R., & Fleming, M. (1998). Measuring safety climate on offshore installations. *Work & Stress, 12*, 238-254.

Mearns, K., Flin, R., Gordon, R., & Fleming, M. (2001). Human and organizational factors in offshore safety. *Work & Stress*, *15*, 144-160.

Mearns, K., Rundmo, T., Flin, R., Gordon, R., & Fleming, M. (2004). Evaluation of psychosocial and organizational factors in offshore safety: A comparative study. *Journal of Risk Research*, *7*, 545-561.

Mearns, K., Whitaker, S.M., & Flin, R. (2001). Benchmarking safety climate in hazardous environments: A longitudinal, interorganizational approach. *Risk Analysis*, *21*, 771-786.

Mearns, K., Whitaker, S.M., & Flin, R. (2003). Safety climate, safety management practice and safety performance in offshore environments. *Safety Science*, *41*, 641-680.

Mershon, B., & Gorsuch, R.L. (1988). Number of factors in the personality sphere: Does increase in factors increase predictability of real-life criteria? *Journal of Personality and Social Psychology*, *55*, 675-680.

Meyer, J.P., & Herscovitch, L. (2001). Commitment in the workplace: Toward a general model. *Human Resource Management Review, 11*, 299-326.

Mishel, W. (2004). Toward an integrative science of the person. *Annual Review of Psychology*, *55*, 1-22.

Moon, H. (2001). The two faces of conscientiousness: Duty and achievement striving in escalation of commitment dilemmas. *Journal of Applied Psychology, 86,* 533-540.

Moran, E., & Volkwein, J. (1992). The cultural approach to the formation of organizational climate. *Human Relations, 45,* 19-47.

Motowidlo, S.J., Borman, W.C., & Schmit, M.J. (1997). A theory of individual differences in task and contextual performance. *Human Performance, 10,* 71-83.

Mullen, J. (2004). Investigating factors that influence individual safety behavior at work. *Journal of Safety Research, 35,* 275-285.

Mullen, J.E., & Kelloway, E.K. (2009). Safety leadership: A longitudinal study of the effects of transformational leadership on safety outcomes. *Journal of Occupational and Organizational Psychology, 82,* 253-272.

Nahrgang, J.D., Morgeson, F.P., & Hofmann, D.A. (2011). Safety at work: A meta-analytic investigation of the link between job demands, job resources, burnout, engagement, and safety outcomes. *Journal of Applied Psychology, 96,* 71-94.

Naveh, E., Katz-Navon, T., & Stern, Z. (2005). Treatment errors in healthcare: A safety climate approach. *Management Science, 51,* 948-960.

Neal, A. & Griffin, M.A. (2004). Safety climate and safety at work. In J. Barling & M.R. Frone (Eds.), *The psychology of workplace safety,* (pp. 15-34). Washington, D.C.: American Psychological Association.

Neal, A., & Griffin, M.A. (2006). A study of the lagged relationships among safety climate, safety motivation, safety behavior and accidents at the individual and group levels. *Journal of Applied Psychology, 91*, 946-953.

Neal, A., Griffin, M.A., & Hart, P.M. (2000). The impact of organizational climate on safety climate and individual behavior. *Safety Science, 34*, 99-109.

Neville, H. (1998). *Workplace accidents: They cost more than you think*. Retrieved July 3, 2008 from http://www.allbusiness.com/specialty-businesses/671508-1.html.

Newman, S., & Griffin, M.A. (2008). Safety in work vehicles: A multilevel study linking safety values and individual predictors to work-related driving crashes. *Journal of Applied Psychology, 93*, 632-644.

Newman, S., Griffin, M.A., & Mason, C. (2008). Safety in work vehicles: A multilevel study linking safety values and individual predictors to work-related driving crashes. *Journal of Applied Psychology, 93*, 632-644.

Nezlek, J.B. (2001). Multilevel random coefficient analysis of event- and interval-contingent data in social and personality psychology research. *Personality and Social Psychology Bulletin, 27*, 771-785.

Nielsen, K.J., Carstensen, O., & Rasmussen, K. (2006). The prevention of occupational injuries in two industrial plants using an incident reporting scheme. *Journal of Safety Research, 37*, 479-486.

Niskanen, T. (1994). Safety climate in the road administration. *Safety Science, 17*, 237-255.

Norman, D.A. (1981). Categorization of action slips. *Psychological Review, 88,* 1-15.

Oliver, A., Cheyne, A., Tomas, J.M., & Cox, S. (2002). The effects of organizational and individual factors on occupational accidents. *Journal of Occupational and Organizational Psychology*, *75*, 473-488.

Ones, D.S., & Viswesvaran, C. (1996). Bandwidth-fidelity dilemma in personality measurement for personnel selection. *Journal of Organizational Behavior*, *17*, 609-626.

Ozkan, T., & Lajunen, T. (2007). The role of personality, culture, and economy on unintentional fatalities: An aggregated level analysis. *Personality and Individual Differences*, *43*, 519-530.

Parker, S.K., & Sprigg, C.A. (1999). Minimizing strain and maximizing learning: The role of job demands, job control, and proactive personality. *Journal of Applied Psychology, 84,* 925-939.

Parkes, K.R. (1986). Coping in stressful episodes: The role of individual differences, environmental factors, and situational characteristics. *Journal of Personality and Social Psychology*, *51,* 1277-1292.

Parkes, K.R. (1990). Coping, negative affectivity, and the work environment: Additive and interactive predictors of mental health. *Journal of Applied Psychology*, *75,* 399-409.

Paunonen, S.V. (1998). Hierarchical organization of personality and prediction of behavior. *Journal of Personality and Social Psychology*, *74*, 528-556.

Paunonen, S.V., & Ashton, M.C. (2001a). Big Five factors and facets and the prediction of behavior. *Journal of Personality and Social Psychology, 81,* 524-539.

Paunonen, S.V., & Ashton, M.C. (2001b). Big five predictors of academic achievement. *Journal of Research in Personality, 35,* 78-90.

Paunonen, S.V., Rothstein, M.G., & Jackson, D.N. (1999). Narrow reasoning about the use of broad personality measures for personnel selection. *Journal of Organizational Behavior, 20,* 389-405.

Peterson C.L., & Mayhew, C. (2005). *Occupational health and safety: International influences and the 'new' epidemics*. NY: Baywood Publishing Co.

Probst, T.M., & Brubaker, T.L. (2001). The effects of job insecurity on employee safety outcomes: Cross-sectional and longitudinal explorations. *Journal of Occupational Health Psychology, 6,* 139-159.

Probst, T.M., Brubaker, T.L., & Barsotti, A. (2008). Organizational injury underreporting: The moderating effect of organizational safety climate. *Journal of Applied Psychology, 93,* 1147-1154.

Prussia, G.E., Brown, K.A., & Willis, P.G. (2003). Mental models of safety: Do managers and employees see eye to eye? *Journal of Safety Research, 34,* 143-156.

Reason, J. (1984). Lapses of attention in everyday life. In R. Parasuraman & D.R. Davies (Eds.), *Varieties of attention* (pp. 1-27). London: Academic Press.

Reason, J. (1988). Stress and cognitive failure. In S. Fisher & J. Reason (Eds.), *Handbook of life stress, cognition, and health* (pp. 405-421). NY: Wiley.

Reason, J.T. (1990). *Human error*. Cambridge, England: Cambridge University Press.

Reason, J.T., & Lucas, D. (1984). Absent-mindedness in shops: Its incidence, correlates and consequences. *British Journal of Clinical Psychology, 23*, 121-131.

Reber, R.A., & Wallin, J.A. (1984). The effects of training, goal setting and knowledge or results on safe behavior: A component analysis. *Academy of Management Journal, 27*, 544-560.

Reynolds, B., & Schiffbauer, R.M. (2004). Impulsive choice and workplace safety: A new area of inquiry for research in occupational settings. *The Behavior Analyst, 27*, 239-246.

Robertson, I.H., Manly, T., Andrade, J., Baddeley, B.T., & Yiend, J. (1997). 'Ooops!': Performance correlates of everyday attentional failures in traumatic brain injured and normal subjects. *Neuropsychologia*, *35*, 747-758.

Rothstein, M.G., Paunonen, S.V., Rush, J.C., & King, G.A. (1994). Personality and cognitive ability predictors of performance in graduate business school. *Journal of Educational Psychology*, *86*, 516-530.

Rotter, J.B. (1966). Generalized expectancies for internal versus external control of reinforcement. *Psychological Monographs*, *80*, (1, Whole No. 609).

Rundmo, T. (1992). Risk perception and safety on offshore petroleum platforms, Part II: Perceived risk, job stress and accidents. *Safety Science, 15*, 53-68.

Rundmo, T. (2001). Employee images of risk. *Journal of Risk Research, 4,* 393-404.

Salgado, J.F. (2002). The big five personality dimensions and counterproductive behaviors. *International Journal of Selection and Assessment, 10,* 117-125.

Sanders, M.S., & McCormick, E.J. (1993). *Human factors in engineering and design* (7th ed.). NY: McGraw-Hill.

Saucier, G., & Ostendorf, F. (1999). Hierarchical subcomponents of the Big Five personality factors: A cross-language replication. *Journal of Personality and Social Psychology, 76,* 613-627.

Scandura, T.A., & Graen, G.B. (1984). Moderating effects of initial Leader-Member Exchange status on the effects of a leadership intervention. *Journal of Applied Psychology, 69,* 428-436.

Schaefer, J.A., & Moos, R.H. (1996). Effects of work stressors and work climate on long-term care staff's job morale and functioning. *Research in Nursing and Health, 19,* 63-73.

Schmidt, F.L., & Kaplan, L.B. (1971). Composite vs. multiple criteria: A review and resolution of the controversy. *Personnel Psychology, 24,* 419-434.

Schneider, B., & Gunnarson, S. (1991). Organizational climate and culture: the psychology of the workplace. In J. James, B. Steffy, & D. Bray (Eds.), *Applying psychology in business,* (pp. 542-551). Lexington, MA: Lexington Books.

Schneider, R.J., Hough, L.M., & Dunnette, M.D. (1996). Broadsided by broad traits: How to sink science in five dimensions or less. *Journal of Organizational Behavior, 17,* 639-655.

Seo, D., Tabari, M.R., Blair, E.H., & Ellis, N.T. (2004). A cross-validation of safety climate scale using confirmatory factor analytic approach. *Journal of Safety Research, 35,* 427-445.

Shannon, H.S., Mayr, J., & Haines, T. (1997). Overview of the relationship between organizational and workplace factors and injury rates. *Safety Science, 26,* 201-217.

Shrout, P.E., & Fleiss, J.L. (1979). Intraclass correlations: Uses in assessing rater reliability. *Psychological Bulletin, 86,* 420-428.

Siebert, S.E., Crant, J.M., & Kraimer, M.L. (1999). Proactive personality and career success. *Journal of Applied Psychology, 84,* 416-427.

Siebert, S.E., Kraimer, M.L., & Crant, J.M. (2001). What do productive people do? A longitudinal model linking proactive personality to career success. *Personnel Psychology, 54,* 845-874.

Silva, S., Lima, M.L., & Baptista, C. (2004). OSCI: an organizational and safety climate inventory. *Safety Science, 42,* 205-220.

Simard, M., & Marchand, A. (1995). A multilevel analysis of organizational factors related to the taking of safety initiatives by workgroups. *Safety Science, 21,* 113-129.

Simard, M., & Marchand, A. (1997). Workgroups' propensity to comply with safety rules: The influence of micro-macro organizational factors. *Ergonomics, 40*, 172-188.

Siu, O.L., Phillips, D.R., & Leung, T.W. (2004). Safety climate and safety performance among construction workers in Hong Kong: The role of psychological strains as mediators. *Accident Analysis and Prevention, 36*, 359-366.

Smith, G.S., Huang, Y.H., Ho, M., & Chen, P.Y. (2006). The relationship between safety climate and injury rates across industries: The need to adjust for injury hazard rates. *Accident Analysis and Prevention, 38*, 556-562.

Sobel, M.E. (1982). Asymptotic confidence intervals for indirect effects in structural equation models. In S. Leinhart (ed.), *Sociological methodology*, Vol. 13, pp. 290-312. SF: Jossey-Bass.

Stajkovic, A.D., & Luthans, F. (1997). A meta-analysis of the effects of organizational behavior modification on task performance, 1975-95. *Academy of Management Journal, 40*, 1122-1149.

Stajkovic, A.D., & Luthans, F. (2001). Differential effects of incentive motivators on work performance. *Academy of Management Journal, 44*, 580-590.

SPSS. (2009). *PASW statistics gradpack 18*. Chicago, IL: SPSS Inc.

Staw, B.M., & Barsade, S.G. (1993). Affect and managerial performance: A test of the sadder-but-wiser vs. happier and smarter hypotheses. *Administrative Science Quarterly, 38*, 304-331.

Stewart, G.L. (1999). Trait bandwidth and stages of job performance: Assessing differential effects for conscientiousness and its subtraits. *Journal of Applied Psychology*, *84*, 959-968.

Tett, R.P., Jackson, D.N., & Rothstein, M. (1991). Personality measures as predictors of job performance: A meta-analytic review. *Personnel Psychology*, *44*, 703-742.

Thoms, P., & Venkataraman, R.R. (2002). Relation of managers' personality to accident and injury rates. *Psychological Reports*, *91*, 1107-1115.

Truxillo, D.M., Bauer, T.N., Reiser, A., & Bertolino, M. (2006). Individual differences, safety motivation, and behavioral intentions: An expectancy-based approach. Poster session presented at the annual meeting of the Society for Industrial/Organizational Psychology, Los Angeles, CA.

Truxillo, D.M., Buck, M.A., McCune, E., Bauer, T.N., Hammer, L., & Bertolino, M. (2007). Validity evidence for an expectancy-based measure of safety motivation. Poster session presented at the annual meeting of the Society for Industrial/Organizational Psychology, New York, NY.

Tsui, A.S., Pearce, J.L., Porter, L.W., & Tripoli, J.M. (1997). Alternative approaches to the employee-organization relationship: Does investment in employees pay off? *Academy of Management Journal*, *40*, 1089-1121.

Tucker, S., Chmiel, N., Turner, N., Hershcovis, S., & Stride, C.B. (2008). Perceived organizational support for safety and employee safety voice: The mediating

role of coworker support for safety. *Journal of Occupational Health Psychology, 13*, 319-330.

Varonen, U., & Mattila, M. (2000). The safety climate and its relationship to safety practices, safety of the work environment and occupational accidents in eight wood-processing companies. *Accident Analysis & Prevention, 32*, 761-769.

Van Eerde, W., & Thierry, H. (1996). Vroom's expectancy models and work-related criteria: A meta-analysis. *Journal of Applied Psychology, 81*, 575-586.

Viswesvaran, C. (2000). Assessment of individual job performance: A revies of the past century and a look ahead. In N. Anderson, D.S. Ones, H.K. Sinagil, & C. Viswesvaran (Eds.), *Handbook of industrial, work, and organizational psychology: Volume 1*, (pp. 110-126). London: Sage Publications.

Wallace, C., & Chen, G. (2006). A multilevel integration of personality, climate, self-regulation, and performance. *Personnel Psychology, 59*, 529-557.

Wallace, J.C., Kass, S.J., & Stanny, C. (2001). Predicting performance in 'go' situations: A new use for the Cognitive Failures Questionnaire. *North American Journal of Psychology, 3*, 481-490.

Wallace, J.C., Kass, S.J., & Stanny, C.J. (2002). The Cognitive Failures Questionnaire revisited: Dimensions and correlates. *The Journal of General Psychology, 129*, 238-256.

Wallace, J.C., Popp, E., & Mondore, S. (2006). Safety climate as a mediator between foundation climates and occupational accidents: A group-level investigation. *Journal of Applied Psychology, 91*, 681-688.

Wallace, J.C., & Vodanovich, S.J. (2003a). Workplace safety performance: Conscientiousness, cognitive failure, and their interaction. *Journal of Occupational Health Psychology, 8,* 316-327.

Wallace, J.C., & Vodanovich, S.J. (2003b). Can accidents and industrial mishaps be predicted? Further investigation into the relationship between cognitive failure and reports of accidents. *Journal of Business and Psychology, 17,* 503-514.

Wallace, J.C., Vodanovich, S.J., & Restino, B.M. (2003). Predicting cognitive failures from boredom proneness and daytime sleepiness scores: An investigation within military and undergraduate samples. *Personality and Individual Differences, 34,* 635-644.

Walumbwa, F.O., & Schaubroeck, J. (2009). Leader personality traits and employee voice behavior: Mediating roles of ethical leadership and workgroup psychological safety. *Journal of Applied Psychology, 94,* 1275-1286.

Watson, D., & Clark, L.A. (1984). Negative affectivity: The disposition to experience aversive emotional states. *Psychological Bulletin, 96* 465-490.

Watson, D., & Tellegen, A. (1985). Toward a consensual structure of mood. *Psychological Bulletin, 103,* 193-210.

Watson, D., Clarke, L.A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect. *Journal of Personality and Social Psychology, 96,* 465-490.

Watson, G.W., Scott, D., Bishop, J., & Turnbeaugh, T. (2005). Dimensions of interpersonal relationships and safety in the steel industry. *Journal of Business and Psychology*, *19*, 303-318.

Wells, M., Stokols, D., McMahan, S., & Clitheroe, C. (1997). Evaluation of a worksite injury and illness prevention program: Do the effects of the REACH OUT training program reach the employees? *Journal of Occupational Health Psychology*, *2*, 25-34.

Westaby, J.D., & Lee, B.C. (2003). Antecedents of injury among youth in agricultural settings: A longitudinal examination of safety consciousness, dangerous risk taking, and safety knowledge. *Journal of Safety Research, 34*, 227-240.

Wiegmann, D.A., Zhang, H., von Thaden, T.L., Sharma, G., & Gibbons, A.M. (2004). Safety culture: An integrative review. *The International Journal of Aviation Psychology, 14*, 117-134.

Williamson, A.M., Feyer, A.M., Cairns, D., & Biancotti, D. (1997). The development of a measure of safety climate: The role of safety perceptions and attitudes. *Safety Science*, *25*, 15-27.

Wills, A.R., Watson, B., & Biggs, H.C. (2006). Comparing safety climate factors as predictors of work-related driving behavior. *Journal of Safety Research, 37*, 375-383.

Yukl, G. (1989). Managerial leadership: A review of theory and research. *Journal of Management*, *15*, 251-289.

Zacharatos, A., Barling, J., & Iverson, R.D. (2005). High-performance work systems and occupational safety. *Journal of Applied Psychology, 90*, 77-93.

Zohar, D. (1980). Safety climate in industrial organizations: Theoretical and applied implications. *Journal of Applied Psychology, 65*, 96-102.

Zohar, D. (2000). A group-level model of safety climate: Testing the effect of group climate on microaccidents in manufacturing jobs. *Journal of Applied Psychology*, *85*, 587-596.

Zohar, D. (2002). Modifying supervisory practices to improve subunit safety: A leadership-based intervention model. *Journal of Applied Psychology, 87*, 156-163.

Zohar, D. (2003a). Safety climate: Conceptual and measurement issues. In J.C. Quick & L.E. Tetrick (Eds.), *Handbook of occupational health psychology* (pp. 123-142). Washington, D.C.: American Psychological Association.

Zohar, D. (2003b). The influence of leadership and climate on occupational health and safety. In D.A. Hofmann & L.E. Tetrick (Eds.), *Health and safety in organizations: A multilevel perspective* (pp. 201-230). San Francisco: Jossey-Bass.

Zohar, D., & Luria, G. (2003). The use of supervisory practices as leverage to improve safety behavior: A cross-level intervention model. *Journal of Safety Research*, *34*, 567-577.

Zohar, D., & Luria, G. (2005). Multilevel model of safety climate: Cross-level relationships between organization and group-level climates. *Journal of Applied Psychology*, *90*, 616-628.

Zohar, D., & Tenne-Gazit, O. (2008). Transformational leadership and group interaction as climate antecedents: A social network analysis. *Journal of Applied Psychology*, *93*, 744-757.

Appendix A

Supervisor Survey

Informed Consent Cover Letter

You are invited to participate in a study I am conducting with Leslie Hammer and Donald Truxillo at Portland State University. We are studying the factors affecting the work environment and safety conditions in the workplace. All maintenance and construction workers at the Water Bureau are invited to participate in the study.

If you decide to participate, we ask that you complete a two-part questionnaire which should take about 30 minutes of your time. The first part asks for your information and about your opinions at work. The second shorter part asks about your workgroup members. After you have completed both parts of the questionnaire please place it in an envelope, seal it, and return it to the researcher.

All information in this study that can be linked to you will be kept strictly confidential. We ask you to provide your name and the names of your workgroup members only so that we can analyze the data by workgroups. In addition, the names of all study participants will be entered into a gift card lottery. The names of all the research participants will be kept only in coded form, and only the researcher will have access to the master list of names and codes. The results of this research will only be reported in aggregate form (everyone's information will be pooled together and summarized). **No information on any individual or workgroup will be provided to management.**

Your participation is voluntary. You do not have to take part in this study. Your participation will not affect your standing as an employee at the Water Bureau. You may also withdraw from this study at any time without affecting your relationship with the Water Bureau. While you may not receive direct benefits from completing the survey, the information from this study may be used to improve safety programs and human resource practices at the Water Bureau. To express our appreciation for your participation, we will conduct a drawing and distribute six Visa gift cards worth $50 (chances of winning about 1 in 60).

If you have concerns or problems about your participation in this study or your rights as a research subject, please contact the Human Subjects Research Review Committee, Office of Research and Sponsored Projects, 600 Unitus Bldg., Portland State University, (503) 725-4288 / 1-877-480-4400. If you have questions about the study itself, contact Michael Buck at (503) 464-6699 or mbuck@pdx.edu, or Dr. Donald Truxillo at (503) 725-3969 or truxillod@pdx.edu.

Completion and submission of the questionnaire indicates that you consent to participate in the study.

Please retain this letter for your reference.

Agreeableness Facets (Goldberg, 1999).

These phrases describe people's behaviors. Please use the rating scale below to describe how accurately each statement describes how you generally are. For each statement please rate your level of agreement or disagreement by CIRCLING the appropriate number.	Very Accurate Moderately Accurate Neutral Moderately Inaccurate Very Inaccurate				
	CIRCLE ONE				
1. I trust others.	1	2	3	4	5
2. I believe that others have good intentions.	1	2	3	4	5
3. I trust what people say.	1	2	3	4	5
4. I believe that people are basically moral.	1	2	3	4	5
5. I believe in human goodness.	1	2	3	4	5
6. I think that all will be well.	1	2	3	4	5
7. I would never cheat on my taxes.	1	2	3	4	5
8. I stick to the rules.	1	2	3	4	5
9. I make people feel welcome.	1	2	3	4	5
10. I anticipate the needs of others.	1	2	3	4	5
11. I love to help others.	1	2	3	4	5
12. I am concerned about others	1	2	3	4	5
13. I have a good word for everyone.	1	2	3	4	5
14. I am easy to satisfy.	1	2	3	4	5
15. I can't stand confrontations.	1	2	3	4	5
16. I hate to seem pushy.	1	2	3	4	5
17. I dislike being the center of attention.	1	2	3	4	5
18. I dislike talking about myself.	1	2	3	4	5
19. I consider myself an average person.	1	2	3	4	5
20. I seldom toot my own horn.	1	2	3	4	5
21. I sympathize with the homeless.	1	2	3	4	5
22. I feel sympathy for those who are worse off than myself.	1	2	3	4	5
23. I value cooperation over competition.	1	2	3	4	5
24. I suffer from others' sorrows.	1	2	3	4	5

Extraversion Facets (Goldberg, 1999).

These phrases describe people's behaviors. Please use the rating scale below to describe how accurately each statement describes how you generally are. For each statement please rate your level of agreement or disagreement by CIRCLING the appropriate number.	Very Accurate Moderately Accurate Neutral Moderately Inaccurate Very Inaccurate				
	CIRCLE ONE				
1. I make friends easily.	1	2	3	4	5
2. I warm up quickly to others.	1	2	3	4	5
3. I feel comfortable around people.	1	2	3	4	5
4. I act comfortably with others.	1	2	3	4	5
5. I cheer people up.	1	2	3	4	5
6. I love large parties.	1	2	3	4	5
7. I talk to a lot of different people at parties.	1	2	3	4	5
8. I enjoy being part of a group.	1	2	3	4	5
9. I involve others in what I am doing.	1	2	3	4	5
10. I love surprise parties.	1	2	3	4	5
11. I take charge.	1	2	3	4	5
12. I try to lead others.	1	2	3	4	5
13. I can talk others into doing things.	1	2	3	4	5
14. I seek to influence others.	1	2	3	4	5
15. I take control of things.	1	2	3	4	5
16. I am always busy.	1	2	3	4	5
17. I am always on the go.	1	2	3	4	5
18. I do a lot in my spare time.	1	2	3	4	5
19. I can manage many things at the same time.	1	2	3	4	5
20. I react quickly.	1	2	3	4	5
21. I love excitement.	1	2	3	4	5
22. I seek adventure.	1	2	3	4	5
23. I love action.	1	2	3	4	5
24. I enjoy being part of a large crowd.	1	2	3	4	5
25. I enjoy being reckless.	1	2	3	4	5
26. I act wild and crazy.	1	2	3	4	5
27. I am willing to try anything once.	1	2	3	4	5
28. I seek danger.	1	2	3	4	5
29. I radiate joy.	1	2	3	4	5
30. I have a lot of fun.	1	2	3	4	5
31. I express childlike joy.	1	2	3	4	5
32. I laugh my way through life.	1	2	3	4	5
33. I love life.	1	2	3	4	5
34. I look at the bright side of life.	1	2	3	4	5
35. I laugh aloud.	1	2	3	4	5
36. I amuse my friends.	1	2	3	4	5

Proactive Personality Siebert, Crant, and Kraimer (1999).

The next set of statements describe common ways people think, feel, and act. How well do these statements describe you? For each statement please rate your level of agreement or disagreement by circling the appropriate number.	Strongly Agree / Agree / Somewhat Agree / Neutral / Somewhat Disagree / Disagree / Strongly Disagree						
	CIRCLE ONE						
1. I am constantly on the lookout for new ways to improve my life.	1	2	3	4	5	6	7
2. Wherever I have been, I have been a powerful force for constructive change.	1	2	3	4	5	6	7
3. Nothing is more exciting than seeing my ideas turned into reality.	1	2	3	4	5	6	7
4. If I see something I don't like, I fix it.	1	2	3	4	5	6	7
5. No matter what the odds, if I believe in something I will make it happen.	1	2	3	4	5	6	7
6. I love being a champion for my ideas, even against others' opposition.	1	2	3	4	5	6	7
7. I excel at identifying opportunities.	1	2	3	4	5	6	7
8. I am always looking for better ways to do things.	1	2	3	4	5	6	7
9. If I believe in an idea, no obstacle will prevent me from making it happen.	1	2	3	4	5	6	7
10. I can spot a good opportunity long before others can.	1	2	3	4	5	6	7

Organizational Safety Climate Zohar and Luria (2005).

These statements describe how managers in your bureau enact safety policies and respond to safety concerns. Please remember your answers <u>will be kept confidential</u>. For each statement please rate your level of agreement or disagreement by CIRCLING the appropriate number.	Completely Agree / Agree / Neutral / Disagree / Completely Disagree				
"Top management in this bureau…"	CIRCLE ONE				
1. Reacts quickly to solve the problem when told about safety hazards.	1	2	3	4	5
2. Insists on thorough and regular safety audits and inspections.	1	2	3	4	5
3. Tries to continually improve safety levels in each department.	1	2	3	4	5
4. Provides all the equipment needed to do the job safely.	1	2	3	4	5
5. Is strict about working safely when work falls behind schedule.	1	2	3	4	5
6. Quickly corrects any safety hazard (even if it's costly).	1	2	3	4	5
7. Provides detailed safety reports to workers (e.g., injuries, near accidents).	1	2	3	4	5
8. Considers a person's safety behavior when moving–promoting people.	1	2	3	4	5
9. Requires each manager to help improve safety in his or her department.	1	2	3	4	5
10. Invests a lot of time and money in safety training for workers.	1	2	3	4	5
11. Uses any available information to improve existing safety rules.	1	2	3	4	5
12. Listens carefully to workers' ideas about improving safety.	1	2	3	4	5
13. Considers safety when setting production speed and schedules.	1	2	3	4	5
14. Provides workers with a lot of information on safety issues.	1	2	3	4	5
15. Regularly holds safety-awareness events like presentations and ceremonies.	1	2	3	4	5
16. Gives safety personnel the power they need to do their job.	1	2	3	4	5
17. Believes workers' safety practices are important for the management of the bureau.	1	2	3	4	5
18. Supervisors and top management seem to care about workers' safety.	1	2	3	4	5

Neuroticism Factor (Goldberg, 1999).

These phrases describe people's behaviors. Please use the rating scale below to describe how accurately each statement describes how you generally are. For each statement please rate your level of agreement or disagreement by CIRCLING the appropriate number.	Very Accurate Moderately Accurate Neutral Moderately Inaccurate Very Inaccurate				
	CIRCLE ONE				
1. I rarely get irritated.	1	2	3	4	5
2. I seldom feel blue.	1	2	3	4	5
3. I feel comfortable with myself.	1	2	3	4	5
4. I am not easily bothered by things.	1	2	3	4	5
5. I am very pleased with myself.	1	2	3	4	5

Supervisor Ratings of Workers' Safety Compliance and Participation Behaviors Adapted from Neal and Griffin (2004).

Please write down YOUR name _____

Work group member name _____

These statements refer to the work behaviors of your workgroup members. For each statement please rate your level of agreement or disagreement by CIRCLING the appropriate number.	Strongly Agree Agree Neutral Disagree Strongly Disagree				
	CIRCLE ONE				
1. The worker uses all the necessary safety equipment to do his/her job.	1	2	3	4	5
2. The worker uses the correct safety procedures for carrying out his/her job.	1	2	3	4	5
3. The worker ensures the highest level of safety when he/she carries out his/her job.	1	2	3	4	5
4. The worker promotes the safety program within the organization.	1	2	3	4	5
5. The worker puts in extra effort to improve the safety of the workplace.	1	2	3	4	5
6. The worker voluntarily carries out tasks or activities that help to improve workplace safety.	1	2	3	4	5

Appendix B

Worker Survey

Informed Consent Cover Letter

You are invited to participate in a study I am conducting with Leslie Hammer and Donald Truxillo at Portland State University. We are studying the factors affecting the work environment and safety conditions in the workplace. All maintenance and construction workers at the Water Bureau are invited to participate in the study.

If you decide to participate, we ask that you complete the questionnaires on the following pages. This survey should take about 30 minutes of your time. While you may not receive direct benefits from completing the survey, the information from this study may be used to improve safety programs and human resource practices at the Water Bureau. To express our appreciation for your participation, we will conduct a drawing and distribute six Visa gift cards worth $50 (chances of winning about 1 in 60).

All information in this study that can be linked to you will be kept strictly confidential. We ask you to provide your name and the name of your lead person only so that we can analyze the data by workgroups. In addition, the names of all study participants will be entered into a gift card lottery. The names of all the research participants will be kept only in coded form, and only the researcher will have access to the master list of names and codes. The results of this research will only be reported in aggregate form (everyone's information will be pooled together and summarized). **No information on any individual or workgroup will be provided to management.**

After you have completed of questionnaire place it in an envelope, seal it, and return it to the researcher. This information will be kept confidential. Your participation is voluntary. You do not have to take part in this study. Your participation will not affect your standing as an employee at the Water Bureau. You may also withdraw from this study at any time without affecting your relationship with the Water Bureau.

If you have concerns or problems about your participation in this study or your rights as a research subject, please contact the Human Subjects Research Review Committee, Office of Research and Sponsored Projects, 600 Unitus Bldg., Portland State University, (503) 725-4288 / 1-877-480-4400. If you have questions about the study itself, contact Michael Buck at (503) 464-6699 or mbuck@pdx.edu, or Dr. Donald Truxillo at (503) 725-3969 or truxillod@pdx.edu.

Completion and submission of the questionnaire indicates that you consent to participate in the study.

Please retain this letter for your reference.

Conscientiousness Facets (Goldberg, 1999).

These phrases describe people's behaviors. Please use the rating scale below to rate how accurately each statement describes how you generally are. For each statement please rate your level of agreement or disagreement by CIRCLING the appropriate number.		Very Accurate Moderately Accurate Neutral Moderately Inaccurate Very Inaccurate				
		CIRCLE ONE				
1.	I complete tasks successfully.	1	2	3	4	5
2.	I excel in what I do.	1	2	3	4	5
3.	I handle tasks smoothly.	1	2	3	4	5
4.	I am sure of my ground.	1	2	3	4	5
5.	I come up with good solutions.	1	2	3	4	5
6.	I know how to get things done.	1	2	3	4	5
7.	I like order.	1	2	3	4	5
8.	I like to tidy up.	1	2	3	4	5
9.	I want everything to be “just right.”	1	2	3	4	5
10.	I love order and regularity.	1	2	3	4	5
11.	I do things according to plan.	1	2	3	4	5
12.	I try to follow the rules.	1	2	3	4	5
13.	I keep my promises.	1	2	3	4	5
14.	I pay my bills on time.	1	2	3	4	5
15.	I tell the truth.	1	2	3	4	5
16.	I listen to my conscience.	1	2	3	4	5
17.	I go straight for the goal.	1	2	3	4	5
18.	I work hard.	1	2	3	4	5
19.	I turn plans into actions.	1	2	3	4	5
20.	I plunge into tasks with all my heart.	1	2	3	4	5
21.	I do more than what’s expected of me.	1	2	3	4	5
22.	I set high standards for myself and others.	1	2	3	4	5
23.	I demand quality.	1	2	3	4	5
24.	I get chores done right away.	1	2	3	4	5
25.	I am always prepared.	1	2	3	4	5
26.	I start tasks right away.	1	2	3	4	5
27.	I get to work at once.	1	2	3	4	5
28.	I carry out my plans.	1	2	3	4	5
29.	I avoid mistakes.	1	2	3	4	5
30.	I choose my words with care.	1	2	3	4	5
31.	I stick to my chosen path.	1	2	3	4	5

Agreeableness Facets (Goldberg, 1999).

These phrases describe people's behaviors. Please use the rating scale below to describe how accurately each statement describes how you generally are. For each statement please rate your level of agreement or disagreement by CIRCLING the appropriate number.		Very Accurate / Moderately Accurate / Neutral / Moderately Inaccurate / Very Inaccurate				
		CIRCLE ONE				
1.	I trust others.	1	2	3	4	5
2.	I believe that others have good intentions.	1	2	3	4	5
3.	I trust what people say.	1	2	3	4	5
4.	I believe that people are basically moral.	1	2	3	4	5
5.	I believe in human goodness.	1	2	3	4	5
6.	I think that all will be well.	1	2	3	4	5
7.	I would never cheat on my taxes.	1	2	3	4	5
8.	I stick to the rules.	1	2	3	4	5
9.	I make people feel welcome.	1	2	3	4	5
10.	I anticipate the needs of others.	1	2	3	4	5
11.	I love to help others.	1	2	3	4	5
12.	I am concerned about others	1	2	3	4	5
13.	I have a good word for everyone.	1	2	3	4	5
14.	I am easy to satisfy.	1	2	3	4	5
15.	I can't stand confrontations.	1	2	3	4	5
16.	I hate to seem pushy.	1	2	3	4	5
17.	I dislike being the center of attention.	1	2	3	4	5
18.	I dislike talking about myself.	1	2	3	4	5
19.	I consider myself an average person.	1	2	3	4	5
20.	I seldom toot my own horn.	1	2	3	4	5
21.	I sympathize with the homeless.	1	2	3	4	5
22.	I feel sympathy for those who are worse off than myself.	1	2	3	4	5
23.	I value cooperation over competition.	1	2	3	4	5
24.	I suffer from others' sorrows.	1	2	3	4	5

Safety Climate from (Zohar, 2000).

	These statements refer to your work group LEAD PERSON'S focus on safety. Please remember that your answers will be kept confidential. For each statement please rate your level of agreement or disagreement by CIRCLING the appropriate number.	Strongly Agree / Agree / Neutral / Disagree / Strongly Disagree				
	My lead person…	**CIRCLE ONE**				
1.	Says a good word whenever he/she sees a job done according to safety rules.	1	2	3	4	5
2.	Seriously considers any worker's suggestions for improving safety.	1	2	3	4	5
3.	Approaches workers during work to discuss safety issues.	1	2	3	4	5
4.	Gets annoyed with any worker ignoring safety rules, even minor rules.	1	2	3	4	5
5.	Watches more often when a worker has violated some safety rule.	1	2	3	4	5
6.	Doesn't care how the work is done as long as there is no accident.	1	2	3	4	5
7.	Whenever the pressure builds, he/she wants us to work faster rather than by the rules.	1	2	3	4	5
8.	Pays less attention to safety problems than other lead persons in this bureau.	1	2	3	4	5
9.	Only keeps track of major safety problems and overlooks routine problems.	1	2	3	4	5
10.	As long as work remains on schedule, he/she doesn't care how this has been achieved.	1	2	3	4	5

Safety Motivation (Truxillo et al., 2006, 2007).

	These statements refer to your thoughts and feelings about safety. For each statement please rate your level of agreement or disagreement by CIRCLING the appropriate number.	Strongly Agree / Agree / Neutral / Disagree / Strongly Disagree				
		CIRCLE ONE				
1.	Safety on the job is something I value highly.	1	2	3	4	5
2.	It is important to avoid accidents at work.	1	2	3	4	5
3.	Job safety is important to me.	1	2	3	4	5
4.	Safety is an important work goal.	1	2	3	4	5
5.	If I perform all necessary safety procedures, it will lead to a safe work environment.	1	2	3	4	5
6.	If I stick to the safety rules, I can avoid accidents.	1	2	3	4	5
7.	How accurately I perform given safety procedures will affect whether my workplace will be safe.	1	2	3	4	5
8.	I can create a safe work environment if I carry out safety procedures.	1	2	3	4	5
9.	The more safety procedures I perform, the more likely I am to avoid accidents.	1	2	3	4	5
10.	I can perform the safety procedures if I try.	1	2	3	4	5
11.	In my work setting, I can actually perform the suggested safety procedures.	1	2	3	4	5
12.	If I put in the effort, I am able to engage in safe behaviors at work.	1	2	3	4	5
13.	If I put forth effort, I am able to comply with safety procedures.	1	2	3	4	5

Safety Compliance and Participation Behaviors (Neal and Griffin, 2004).

These statements refer to *YOUR* work behavior. For each statement please rate your level of agreement or disagreement by CIRCLING the appropriate number.	Strongly Agree / Agree / Neutral / Disagree / Strongly Disagree				
	CIRCLE ONE				
1. I use all the necessary safety equipment to do my job.	1	2	3	4	5
2. I use the correct safety procedures for carrying out my job.	1	2	3	4	5
3. I ensure the highest level of safety when I carry out my job.	1	2	3	4	5
4. I promote the safety program within the organization.	1	2	3	4	5
5. I put in extra effort to improve the safety of the workplace.	1	2	3	4	5
6. I voluntarily carry out tasks or activities that help to improve workplace safety.	1	2	3	4	5

Accidents & Injuries

- **How many times in the last 6 months have you experienced each of these injuries <u>at work</u>?**
- **Please enter the number of injuries and near misses experienced in the boxes provided.**
- **A "near miss" is an accident at work that almost occurred.**

Type of Injury	INJURY	NEAR MISS
Burns or scalds		
Contusions, crushing bruises		
Scratches, abrasions (superficial wounds)		
Sprains, strains		
Concussions		
Cuts, lacerations, punctures (open wounds)		
Fractures		
Hernia		
Tendonitis		
Slips, trips and falls		

In the last 6 months how many days of work have you missed after being hurt (injured) at work? _____