



IMPROVING SAFETY-RELATED BEHAVIOR IN THE WORKPLACE

THE DEVELOPMENT AND VALIDATION OF SAFETY COMPETENCY SCALES



The Development and Validation of Safety Competency Scales

Hogan Assessment Systems

2010

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www.hoganpress.com

ISBN 978-0-9840969-7-8



CONTENTS

1.	INTRODUCTION	1
	1.1 Background	1
	1.2 Overview	3
2.	THE HOGAN PERSONALITY INVENTORY (HPI)	4
	2.1 Approach and Rationale	4
	2.2 The Five Factor Model (FFM)	4
	2.3 Comparing the HPI to Other FFM Instruments	6
	2.4 HPI Description and Development	9
	2.5 Homogenous Item Composites (HICs)	. 11
3.	SAFETY COMPETENCY MODEL	14
	3.1 Purpose and Application	. 14
	3.2 Structure	. 15
	3.3 Constructing Facet-level Personality Scales for Predicting Safety Competencies	. 16
	3.4 Research Approach and Rationale	. 17
	STUDY 1: DEVELOPMENT OF FACET-LEVEL PERSONALITY SCALES ASSOCIATED ITH SAFETY COMPETENCIES	18
	4.1 Scale Development	. 18
	4.2 Method	. 19
	4.2.1 Case Selection	. 20
	4.2.2 Job Analysis	21
	4.2.3 Meta-Analysis Procedures	. 21
	4.3 Results	. 22

5.	STU	DY 2: VALIDATION OF SAFETY SCALES	24
	5.1	Validation Methods	24
	5.2	Results for Meta-Analysis of Safety Scales	24
	5.3	Construct Validity of the Safety Scales	27
	5.4	Averaged Safety Scale Results	32
	5.5	Summary of Studies 1 and 2	33
6.	GEN	IERAL EMPLOYABILITY SCALES	34
	6.1	General Employability Scales	34
	6.2	Validity of the General Employability Scales	35
	6.3	Cross Validation	36
	THE	UTILITY AND VALIDITY OF SAFETY SCALES FOR OBJECTIVE WORK MES	38
	7.1	Case Study #1	39
	7.2	Case Study #2	40
	7.3	Case Study #3	41
	7.4	Case Study #4	42
	7.5	Case Study #5	43
	7.6	Case Study #6	43
	7.7	Case Study #7	44
	7.8	Summary of Case Study Results	45
8.	APP	LICATIONS AND RECOMMENDATIONS	46
	8.1	Scoring	46
	8.2	Simulated Adverse Impact	47
	8.3	Uses and Applications	52

	8.4 Accuracy and Completeness	. 53
9.	COMPILATION OF NORMS	54
	9.1 Importance of Norms for Interpretation and Decision-Making	. 54
	9.1.1 Presentation of Normative Data	. 54
	9.1.2 Professional Standards for Norm Development	. 55
	9.2 Norm Composition	. 56
	9.2.1 Stratified Sampling of the Norming Population	. 57
	9.2.2 Job Families	. 57
	9.2.3 Language	. 58
	9.2.4 Gender and Age	. 59
	9.3 Descriptive Statistics of the Norming Sample	. 60
RE	EFERENCES	62
ΑF	PPENDIX A: Comparison between Standard HPI and Safety Report HIC Names	72
ΑF	PPENDIX B: The Competency Evaluation Tool (CET)	74
ΑF	PPENDIX C: Sample Safety Report	77
ΔF	PPENDIX D: Norms for the Total Sample	85

TABLES AND FIGURES

Table 2.1 Correlations between Goldberg's Big-Five Markers and the HPI Scales	6
Table 2.2 Correlations between the PCI Primary Scales and the HPI Scales	7
Table 2.3 Correlations between the IP/5F and the HPI Scales	7
Table 2.4 Correlations between the NEO PI-R and the HPI Scales	7
Figure 2.1 Relationships between FFM Inventories and the HPI Scales	8
Table 2.5 HPI Scales, HICs, Descriptions, and Sample Items	11
Table 3.1 Safety Competencies and Descriptions	16
Table 4.1 HPI HICs Mapped to Safety Competencies	18
Table 4.2 Meta-Analysis Estimates of Safety Scales for Predicting Aligned Safety Competency Ratings	23
Table 5.1 Meta-Analysis Estimates of Safety Scales and Broad HPI Scales for Predicting Overall Safety Performance Ratings	25
Table 5.2 Intercorrelations between Safety Scales	27
Table 5.3 Correlations between Safety Scales and FFM and Selected Personality Inventory Scales	29
Table 5.4 Validity Results for Safety Competency Model	32
Table 6.1 Validity Results for Competency Algorithms	35
Table 6.2 Validity Results for Average Scale Score and Overall Job Performance	36
Table 7.1 Results for Case Study #4	42
Table 7.2 Results for Case Study #5	43
Table 7.3 Results for Case Study #6	44
Table 8.1 Scale Means and Standard Deviations	46
Table 8.2 Compliant Safety Scale Adverse Impact Results	47

Table 8.3 Strong Safety Scale Adverse Impact Results	. 48
Table 8.4 Emotionally Stable Safety Scale Adverse Impact Results	. 48
Table 8.5 Vigilant Safety Scale Adverse Impact Results	. 49
Table 8.6 Cautious Safety Scale Adverse Impact Results	. 49
Table 8.7 Trainable Safety Scale Adverse Impact Results	. 50
Table 8.8 Dependability Advantage Scale Adverse Impact Results	. 50
Table 8.9 Composure Advantage Scale Adverse Impact Results	. 51
Table 8.10 Customer Focus Advantage Scale Adverse Impact Results	. 51
Table 9.1 Norming Sample Distribution by U.S. DoL Job Family	. 58
Table 9.2 Norming Sample Distribution by Language	. 59
Table 9.3 Norming Sample Distribution by Gender and Age	. 60
Table 9.4 Norming Sample Scale Means and Standard Deviations	. 60
Table A1 Comparison between Standard HPI and Safety Report HIC Names	. 73
Table D1 Norms for the Total Sample	. 86

1. INTRODUCTION

1.1 Background

The U.S. Department of Labor, Bureau of Labor Statistics (2007) reported 4.1 million cases of injuries and illnesses with lost workdays in 2006, resulting in 4.4 cases per 100 full-time employees in the private sector. In the U.S. alone, injured employees cost organizations nearly \$1 billion per week in direct and indirect costs (Liberty Mutual Research Institute for Safety, 2008). Direct costs include worker compensation payments, medical expenses, and payments for legal services. Indirect costs include training for replacement employees, accident investigation, implementation of corrective measures, lost productivity, repairs to damaged equipment and property, and costs associated with absenteeism and lower employee morale (United States Department of Labor, Occupational Safety & Health Administration, n.d.).

These data were called into question by the U.S. Government Accountability Office (U.S. GAO, 2009), the auditing arm of the U.S. Congress, indicating that employers underreported actual numbers of workplace injuries and illnesses. In addition, the 2009 U.S. GAO report stated that workers underreported their injuries due to perceived negative consequences—being fired, disciplined, or denied safety rewards. The report concluded that the data compiled between 2005 and 2007 by the Occupational Safety and Health Administration failed to consider up to two-thirds of all workplace injuries and illnesses (U.S. GAO, 2009). This review suggests that the record of workplace safety in the U.S. is more heavily populated with incidents than those reported in Bureau of Labor Statistics documents.

Organizations adopt various strategies to increase workplace safety (Frone, 1998; Geller, 1996; Liao, Arvey, Butler, & Nutting, 2001). These efforts include promoting environmental factors (Lawton & Parker, 1998), addressing counterproductive work behaviors (Douglas & Martinko, 2001; Mount, Ilies, & Johnson, 2006), reducing occupational stress and strain (Geller, 1996; Houkes, Janssen, de Jonge, & Bakker, 2003; Zellars, Perrewe, Hochwarter, & Anderson, 2006), instituting risk management initiatives (DePasquale & Geller, 1999; Lawton, Conner, & Parker, 2007; O'Grady & Harman, 2006), and promoting safety values (Newnam, Griffin, & Mason, 2008). A number of researchers have also focused on safety climate (e.g., Beus, Payne, Bergman, & Arthur, 2010; Clarke, 2006b; Zohar, 2003). In a recent meta-analysis examining relationships between safety climate and injuries, Beus et al. (2010) found that perceived management commitment to safety was the most consistent predictor of injuries. They also found, however, that injuries were more predictive of safety climate than safety climate was of injuries. In other words, efforts aimed at reducing injuries by focusing first on safety climate may be limited.

Despite attempts to increase workplace safety, accidents and injuries continue to occur. Diminishing returns associated with environmental interventions promote alternatives such as examining individual differences in employee behaviors (Clarke, 2006a; Clarke & Robertson, 2008; Kamp & Krause, 1997; Lawton & Parker, 1998; Stuhlmacher, Briggs, & Cellar, 2009).

A number of personal attributes contribute to employee safety. Research suggests that personality factors, such as those identified in the Five Factor Model (FFM; Digman, 1990; Goldberg, 1992; John, 1990; McCrae & Costa, 1987), are associated with safety behavior (Cellar, Nelson, York, & Bauer, 2001; Conte & Jacobs, 2003; Hanson, 1988; Salgado, 2002; Stuhlmacher et al., 2009; Thoresen, Bradley, Bliese, & Thoresen, 2004). Specifically, conscientious employees (Christian, Bradley, Wallace, & Burke, 2009; Demerouti, 2006; Dudley, Orvis, Lebiecki, & Cortina, 2006; Wallace & Chen, 2006; Wallace & Vodanovich, 2003) and emotionally stable employees (Clarke & Robertson, 2008; Liao et al., 2001; Smillie, Yeo, Furnham, & Jackson, 2006) tend to be safer than those who are undependable or anxious.

To help organizations identify job applicants who are likely to engage in safe and productive behaviors, Hogan Assessment Systems (Hogan) developed personalitybased scales to predict safety-related behaviors. This report describes the development of these predictor scales, which are linked to six safety-related and three general employability competencies that form the core of the Hogan Safety Report. Also, we demonstrate the validity of these scales for predicting both safetyrelated and other critical work behaviors. Finally, we show how these scales predict critical work outcomes such as accidents and injuries. This research conforms to standards outlined in the Uniform Guidelines on Employee Selection Procedures (Equal Employment Opportunity Commission [EEOC], 1978; hereafter "Uniform Guidelines"), the Principles for the Validation and Use of Personnel Selection Procedures (Society for Industrial and Organizational Psychology [SIOP], 2003; hereafter "Principles"), and the Standards for Educational and Psychological Testing (American Educational Research Association [AERA], American Psychological Association [APA], & National Council on Measurement in Education [NCME], 1999; hereafter "Standards"). In areas where the Uniform Guidelines, Principles or Standards proved vague or inapplicable, we relied on the broader scientificprofessional literature for guidance.

1.2 Overview

The research described in this manual relies, in part, on archival validation data using the Hogan Personality Inventory (HPI; R. Hogan & J. Hogan, 1995, 2007) as the individual difference predictor of safety and general employability competencies. This document, organized in the following sections, describes the research:

- *Introduction* Overview of research
- The Hogan Personality Inventory (HPI) Description of assessment
- Safety Competency Model Description of competency model
- Study 1: Development of Facet-Level Personality Scales Associated with Safety
 Competencies Study 1 summary
- Study 2: Validation of Safety Scales Study 2 summary
- General Employability Scales Prediction of Dependability, Composure, and Customer Focus
- The Utility and Validity of Safety Scales for Objective Work Outcomes Utility and validity through case studies
- Applications and Recommendations Application of algorithms
- Compilation of Norms Development of the normative dataset

2. THE HOGAN PERSONALITY INVENTORY (HPI)

2.1 Approach and Rationale

Validating selection instruments relies on accurate measurement. In accordance with Ghiselli, Campbell, and Zedeck (1981), we define measurement as any procedure that assigns numbers systematically to characteristic features of people according to explicit rules. Researchers and practitioners can use these numbers to provide feedback or forecast future behavior(s).

Assigning numbers in a systematic fashion to characteristics is a critical, but not sufficient, requirement of any pre-employment selection tool. Every selection tool should provide evidence to support (a) the reliability of the instrument and (b) the relations between scores on the instrument and job-relevant behaviors or outcomes (EEOC, 1978). At a minimum, the reliability of pre-employment assessments should be evaluated in terms of the degree to which (a) items or questions on a scale relate to one another (internal item consistency) and (b) results or scores remain stable over time (test-retest reliability).

Assessment publishers should document the ability of pre-employment instruments to predict job-relevant behaviors or outcomes in credible scientific sources. Supporting evidence should include significant and interpretable relations between scores on the pre-employment instrument and job performance criteria critical to success in the job of interest.

Pre-employment instruments should not discriminate unfairly based on gender, age, or race/ethnicity (EEOC, 1978). Researchers must validate selection procedures that result in adverse impact in accordance with the *Uniform Guidelines*. Unfortunately, many instruments currently used in pre-employment screening processes fail to meet these requirements (R. Hogan, J. Hogan, & Trickey, 1999).

2.2 The Five Factor Model (FFM)

For personality assessment, the most important question is "What should we measure?" Historically, the answer depended on an author's personal interests (e.g., Locus of Control; Rotter, 1966), practical concerns (e.g., Minnesota Multiphasic Personality Inventory; Hathaway & McKinley, 1943), or theory (e.g., Myers-Briggs Type Indicator; Myers, McCaulley, Quenk, & Hammer, 2003; Thematic Apperception Test; Morgan & Murray, 1935). Multi-dimensional personality inventories developed during the 1940s and 1950s measured traits, or hypothetical structures believed to underlie differences in social behavior (cf. Allport, 1937). Early approaches to personality inventory construction led to more advanced test development strategies and improved the quality and interpretability of the instruments.

Current thinking in personality assessment converges on the idea that most personality characteristics can be described in terms of five personality dimensions. The FFM (cf. Digman, 1990; Goldberg, 1992; John, 1990, p. 72; McCrae & Costa, 1987), which emerged from 50 years of factor analytic research on the structure of observer ratings (cf. Norman, 1963; Thurstone, 1934; Tupes & Christal, 1961), suggests that we think about and describe others and ourselves (Goldberg, 1990) in terms of five themes:

- I. Surgency/Extraversion the degree to which a person is outgoing and talkative.
- II. **Agreeableness** the degree to which a person is rewarding to deal with and pleasant.
- III. **Conscientiousness** the degree to which a person complies with rules, norms, and standards.
- IV. Emotional Stability the degree to which a person appears calm and selfaccepting.
- V. **Intellect/Openness to Experience** the degree to which a person seems creative and open-minded.

The FFM provides the starting point for several prominent personality inventories constructed within the last twenty years (e.g., NEO Personality Inventory-Revised [NEO PI-R]; Costa & McCrae, 1992; HPI; R. Hogan & J. Hogan, 1995, 2007; Personal Characteristics Inventory [PCI]; Mount & Barrick, 2002). The five dimensions provide a useful taxonomy for classifying individual differences in social behavior (i.e., reputation). Evidence suggests that researchers can describe all existing multidimensional personality inventories, with little difficulty, in terms of these five dimensions (Wiggins & Pincus, 1992). Consequently, the FFM is the paradigm for current research in personality assessment (De Raad & Perugini, 2002; R. Hogan & J. Hogan, 1995, 2007).

Observers' descriptions of others serve as the foundation of the FFM. These descriptions form the basis of one's reputation (i.e., how people describe coworkers or peers) (R. Hogan, 1983). Reputations grow from social consensus regarding consistencies in a person's behavior, and develop from behavior during social and occupational interaction. These behaviors consist, at least in part, of actions designed to establish, defend, or enhance that person's identity (i.e., a person's view of him or herself) (cf. Goffman, 1958). Reputations are public, tell us about observable tendencies in others' behaviors, can be measured reliably, and can be used to forecast future behavior (cf. Emler, 1990). A person's reputation represents an invaluable source of information about work-related strengths and shortcomings and influences the direction of careers.

Personality assessment samples self-presentational behavior (i.e., how a person portrays him or herself to others on the job). An assessment instrument allows us to aggregate these behavioral samples, assign them scores according to certain agreed-upon rules, and use these scores to make predictions about a person's future behavior. Research shows that personality is predictive of both work and non-work-related outcomes, such as job performance, leadership, health-related behaviors, life satisfaction, and job satisfaction (Hough & Oswald, 2008; Ozer & Benet-Martinez, 2005; Roberts, Kuncel, Shiner, Caspi, & Goldberg, 2007).

2.3 Comparing the HPI to Other FFM Instruments

The HPI is the first measure of normal personality based on the FFM and designed to predict occupational performance. The measurement goal of the HPI is to predict real-world outcomes. As such, it is an original and well-known measure of the FFM and is considered a marker instrument in English as well as in multiple other languages. Tables 2.1 through 2.4 present correlations between the HPI and other assessments of the FFM. Figure 2.1 shows median correlation coefficients that summarize HPI relations with Goldberg's (1992) Big-Five Markers (R. Hogan & J. Hogan, 2007), the PCI (Mount & Barrick, 2002), the Inventario de Personalidad de Cinco Factores (IP/5F; Salgado & Moscoso, 1999), and the NEO PI-R (Costa & McCrea, 1992).

Table 2.1
Correlations between Goldberg's Big-Five Markers and the HPI Scales

Scale	ADJ	AMB	SOC	INP	PRU	INQ	LRN
Factor I	.04	.55*	.44*	.31*	24*	.29*	03
Factor II	.13	11	.02	.56*	.23*	12	17*
Factor III	.10	.24*	26*	07	.36*	17*	08
Factor IV	.70*	.39*	04	.27*	.01	.28*	.11
Factor V	.05	.22*	04	01	.03	.33*	.35*

Note. N = 168. Table taken from the HPI Manual (R. Hogan & J. Hogan, 2007). Factor I = Surgency; Factor II = Agreeableness; Factor III = Conscientiousness; Factor IV = Emotional Stability; Factor V = Intellect; ADJ = Adjustment; AMB = Ambition; SOC = Sociability; INP = Interpersonal Sensitivity; PRU = Prudence; INQ = Inquisitive; LRN = Learning Approach.

^{*}p < .05, one-tailed; directional relationships hypothesized a priori.

Table 2.2
Correlations between the PCI Primary Scales and the HPI Scales

Scale	ADJ	AMB	SOC	INP	PRU	INQ
Extraversion	.04	.39*	.64*	.26*	09	.18*
Agreeableness	.50*	.25*	.09	.61*	.21*	03
Conscientiousness	.24*	.39*	06	.17*	.59*	.08
Stability	.69*	.59*	02	.46*	.25*	.06
Openness	.12	.36*	.15	.17*	05	.57*

Note. N = 154. ADJ = Adjustment; AMB = Ambition; SOC = Sociability; INP = Interpersonal Sensitivity; PRU = Prudence; INQ = Inquisitive.

Table 2.3 Correlations between the IP/5F and the HPI Scales

Scale	ADJ	AMB	SOC	INP	PRU	INQ
Extraversion	.24*	.60*	.62*	.35*	.04	.41*
Agreeableness	.22*	12	10	.37*	.25*	10
Conscientiousness	.22*	.35*	.08	.30*	.49*	.19*
Stability	66*	50*	16*	31*	32*	26*
Openness	.11	.44*	.51*	.25*	15*	.69*

Note. N = 200. ADJ = Adjustment; AMB = Ambition; SOC = Sociability; INP = Interpersonal Sensitivity; PRU = Prudence; INQ = Inquisitive.

Table 2.4

Correlations between the NEO PI-R and the HPI Scales

Scale	ADJ	AMB	SOC	INP	PRU	INQ	LRN
Extraversion	.16*	.54*	.63*	.44*	06	.22*	.08*
Agreeableness	.31*	12*	24*	.47*	.46*	20*	08*
Conscientiousness	.24*	.37*	05	.08	.42*	.05	.16*
Neuroticism	72*	53*	08*	27*	22*	15*	17*
Openness	.01	.20*	.38*	.19*	31*	.52*	.24*

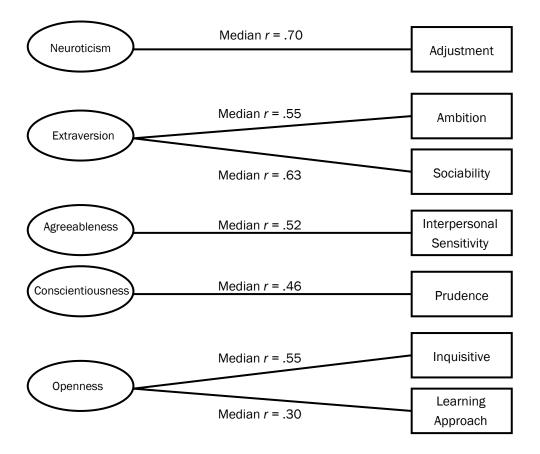
Note. N = 679. ADJ = Adjustment; AMB = Ambition; SOC = Sociability; INP = Interpersonal Sensitivity; PRU = Prudence; INQ = Inquisitive; LRN = Learning Approach.

^{*}p < .05.

^{*}p < .05.

^{*}p < .05.

Figure 2.1
Relationships between FFM Inventories and the HPI Scales



Note. Median correlation coefficients summarize HPI relations with the NEO PI-R (Costa & McCrea, 1992; Goldberg, 2000), Goldberg's (1992) Big-Five Markers (R. Hogan & J. Hogan, 2007), PCI (Mount & Barrick, 2002), and the IP/5F (Salgado & Moscoso, 1999). The coefficient ranges are as follows: Adjustment/ Emotional Stability/Neuroticism (.66 to .72); Ambition/Extraversion/Surgency (.39 to .60); Sociability/ Extraversion/Surgency (.44 to .64); Interpersonal Sensitivity/Agreeableness (.37 to .61); Prudence/ Conscientiousness (.36 to .59); Inquisitive/Openness/Intellect (.33 to .69); Learning Approach/ Openness/Intellect (.24 to .35). Reprinted with permissions from the authors. All rights reserved.

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2.4 HPI Description and Development

HPI Description

- 206 true/false items with no psychiatric content
- 7 personality scales, 1 validity scale, no item overlap
- 4th grade reading level
- 15 to 20 minute completion time
- Items carefully screened to minimize invasion of privacy
- Designed for ages 18 and above
- Internet administration and reporting

HPI Development

- Development began in the late 1970s, based on the FFM, and constructed and validated in accordance with professional standards and the *Uniform Guidelines* (EEOC, 1978). Favorable reviews of the HPI appear in the Buros Institute of Mental Measurements's *The Thirteenth Mental Measurements Yearbook* (Lobello, 1998) and the British Psychological Society's Psychological Testing Centre's *Test Reviews* (Creed & Shackleton, 2007).
- Norms are based on over 150,000 working adults and job applicants from a
 variety of industry sectors including healthcare, military services, transportation,
 protective services, retail, manufacturing, and hospitality. This sample is
 representative of 14 of the 23 U.S. Department of Labor (U.S. DoL, 1991)
 categories.
- The HPI has been used in over 450 validation studies to predict occupational performance across a range of jobs and industries. Jobs studied represent 95% of the industry coverage of the *Dictionary of Occupational Titles* (U.S. DoL, 1991).
- Meta-analyses of HPI scales indicate that the estimated true validities for the HPI scales for predicting job performance are as follows: Adjustment (.43), Ambition (.35), Interpersonal Sensitivity (.34), Prudence (.36), Inquisitive (.34), and Learning Approach (.25). These peer-reviewed results appear in the *Journal of Applied Psychology* (J. Hogan & Holland, 2003).
- To date, research indicates no adverse impact by race/ethnicity, gender, or age.

- Research indicates that real job applicants who completed the HPI as part of the
 job application process could not "fake" their scores on a second occasion after
 being rejected the first time (J. Hogan, Barrett, & R. Hogan, 2007).
- The HPI incorporates the FFM with an internal factor structure supporting seven scales. The test-retest reliabilities range from .69 to .87. The third edition of the HPI Manual (R. Hogan & J. Hogan, 2007) documents the background, development, and psychometric properties of the inventory.

Constructs Measured

The HPI scales (and associated FFM constructs measured) are defined as follows:

Adjustment concerns the degree to which a person is steady in the face of pressure, or conversely, moody and self-critical (FFM Emotional Stability).

Ambition reflects the degree to which a person seems leaderlike, status-seeking, and achievement-oriented (FFM Extraversion).

Sociability reflects the degree to which a person needs and/or enjoys social interaction (FFM Extraversion).

Interpersonal Sensitivity concerns the degree to which a person has social sensitivity, tact, and perceptiveness (FFM Agreeableness).

Prudence concerns the degree to which a person seems conforming, dependable and has self-control (FFM Conscientiousness).

Inquisitive concerns the degree to which a person seems imaginative, adventurous, and analytical (FFM Intellect/Openness).

Learning Approach reflects the degree to which a person enjoys academic activities and values education as an end in itself (FFM Intellect/Openness).

In terms of instrument development, Hogan refined an initial pool of 425 items using factor analysis and empirical validation procedures to assign 206 items to seven construct scales. Hogan retained items in the final battery based on their demonstrated ability to predict significant non-test behavior. There is no item overlap among the primary scales and the validity scale.

The HPI is a well-validated instrument that predicts job performance across occupations and organizations (Axford, 1998; J. Hogan & Holland, 2003; R. Hogan & J. Hogan, 2007). Furthermore, the HPI scales demonstrate adequate psychometric qualities (Lobello, 1998).

10

2.5 Homogenous Item Composites (HICs)

During the development of the HPI, it appeared that each scale could be broken down into a set of related themes. Because the items in these themes clustered together, they were named Homogenous Item Composites (Zonderman, 1980), or HICs. For each HPI scale, the items comprising each HIC form small facets that represent themes within the larger construct. The number of these facets varies depending on the scale, ranging from four (Learning Approach) to eight (Adjustment).

In the spring of 1992, Hogan conducted factor analyses on the HIC correlation matrix. Analyses indicated that eight factors underlie the matrix, forming the basis of the HPI scales. Because a few HICs had substantial loadings on two factors, Hogan used this information to balance the number of items on each scale by assigning HICs accordingly. A total of 41 HICs comprise the current version of the HPI, with no overlap between items, HICs, and scales. Table 2.5 presents the HPI scales, HICs underlying each scale, and descriptions and sample items for each HIC.

Table 2.5
HPI Scales, HICs, Descriptions, and Sample Items

HPI Scale	Description	Sample Item
Adjustment		
Empathy	Concern for others	I don't let little things bother me.
Not Anxious	Absence of worry	Deadlines don't bother me.
No Guilt	Absence of regret	I rarely feel guilty about the things I have done.
Calmness	Not volatile	I keep calm in a crisis.
Even Tempered	Patience	I hate to be interrupted.
No Complaints	Complacence	I almost never receive bad service.
Trusting	Belief in others	People really care about one another.
Good Attachment	Good relations with authority	In school, teachers liked me.
Ambition		
Competitive	Desire to win	I want to be a success in life.
Self Confident	Self-assurance	I expect to succeed at everything.
Accomplishment	Personal effectiveness	I am known as someone who gets things done.

Table 2.5 cont.
HPI Scales, HICs, Descriptions, and Sample Items

HPI Scale	Description	Sample Item
Ambition		
Leadership	Leadership tendencies	In a group I like to take charge of things.
Identity	Satisfaction with one's life	I know what I want to be.
No Social Anxiety	Social self confidence	I don't mind talking in front of a group of people.
Sociability		
Likes Parties	Affability	I would go to a party every night if I could.
Likes Crowds	Affiliativeness	Being part of a large crowd is exciting.
Experience Seeking	Needs variety	I like a lot of variety in my life.
Exhibitionistic	Showing off	I like to be the center of attention.
Entertaining	Being witty and engaging	I am often the life of the party.
Interpersonal Sensitivity		
Easy to Live With	Being easy-going	I work well with other people.
Sensitive	Being considerate	I always try to see the other person's point of view.
Caring	Social sensitivity	I am sensitive to other people's moods.
Likes People	Companionable	I enjoy just being with other people.
No Hostility	Tolerant	I would rather not criticize people.
Prudence		
Moralistic	Self-righteousness	I always practice what I preach.
Mastery	Diligent	I do my job as well as I possibly can.
Virtuous	Perfectionism	I strive for perfection in everything I do.
Not Autonomous	Conformity	Other people's opinions of me are important.
Not Spontaneous	Planful	I always know what I will do tomorrow.
Impulse Control	Self-disciplined	I rarely do things on impulse.
Avoids Trouble	Professed probity	When I was in school, I rarely gave the teachers any trouble.
Inquisitive		
Science	Analytical	I am interested in science.
Curiosity	Investigative	I have taken things apart just to see how they work.
Thrill Seeking	Stimulus seeking	I would like to be a race car driver.

Table 2.5 cont.
HPI Scales, HICs, Descriptions, and Sample Items

HPI Scale	Description	Sample Item
Inquisitive		
Intellectual Games	Playful cognition	I enjoy solving riddles.
Generates Ideas	Ideational fluency	I am known for having good ideas.
Culture	Cultural interests	I like classical music.
Learning Approach		
Good Memory	Powers of recall	I have a large vocabulary.
Education	Academic talent	As a child, school was easy for me.
Math Ability	Numerical talent	I can multiply large numbers quickly.
Reading	Verbal talent	I would rather read than watch TV.

3. SAFETY COMPETENCY MODEL

3.1 Purpose and Application

The human factors field dominates research on occupational safety. Although this field has a long tradition of contributions to workplace safety, its effectiveness is constrained by three factors. First, there is a potential for diminishing returns once workplace improvements are implemented (Lawton & Parker, 1998). Second, controlling for all possible workplace hazards is impossible for nearly any job. This is particularly true when employees spend a significant amount of time working outside of a structured environment (i.e., "in the field"). Third, these efforts focus on workplace and environmental factors, ignoring individual worker characteristics.

Such limitations highlight the value of examining the impact of individual differences on safety-related outcomes. Traditionally, much of this work focused on physical abilities, suggesting that organizations should select individuals with the physical attributes needed to engage the work environment safely, or alternatively, train individuals to develop safety-related skills (J. Hogan, 1991).

Early research attempts to identify "accident prone" individuals using psychological assessment produced inconclusive or contradictory results (Lawton & Parker, 1998). However, advancements in personality research sparked a renewed interest in using personality assessment to identify individuals who are more likely to display unsafe behaviors at work. These advancements include the emergence of the FFM and the publication of several studies showing relationships between psychological measures and counterproductive work behaviors (e.g., Cellar et al., 2001; Hanson, 1988; Wallace & Vodanovich, 2003).

Research demonstrates relationships between safety-related job outcomes and four of the five FFM scales. First, a consistent relationship exists between Conscientiousness and safety-related job outcomes (Cellar et al., 2001; Christian et al., 2009; Liao et al., 2001; Wallace & Chen, 2006; Wallace & Vodanovich, 2003), indicating that individuals who are inattentive to detail, unreliable, and have difficulty following rules are more likely to have accidents or injuries. Also, research shows that individuals who are unable to handle stress or cope with uncertain work situations (low Emotional Stability; Clarke & Robertson, 2008; Kamp & Krause, 1997; Liao et al., 2001), have difficulty getting along with others and prefer to work independently (low Agreeableness; Clarke, 2006a), or are overly outgoing and seek being the center of attention (high Extraversion; Hanson, 1988; Liao et al., 2001) are more likely to engage in behaviors that result in workplace injuries or accidents.

In a comprehensive integration of safety research, Christian et al. (2009) describe a model of person- and situation-based factors associated with safety behavior and outcomes. Using meta-analysis methods, they report modest support for a link

between Conscientiousness measures and safety performance as well as accident and injury outcomes. Their Conscientiousness path, however, consisted of only five studies.

In a recent meta-analysis of HPI scales and safety-related work outcomes, Foster and J. Hogan (2005) examined personality scores from 471 individuals across six independent samples. Results demonstrated significant relationships for Adjustment (FFM Emotional Stability, ρ = .21), Interpersonal Sensitivity (FFM Agreeableness, ρ = .12), and Prudence (FFM Conscientiousness, ρ = .21). Results for Sociability (FFM Extraversion, ρ = .01) did not reach significance. However, a single large study with a significant positive relationship between Sociability and supervisors' safety ratings likely biased the results. Four of the remaining five studies showed a negative relationship between Sociability and safety.

Foster and Chen (2007) examined correlations between HPI scales and number of accidents in two large samples from a regional southwestern U.S. energy company. Results for Adjustment, Interpersonal Sensitivity, Prudence and Sociability scales were all in the expected direction, providing evidence for combining the scales into a safety profile. Individuals who fit the safety profile had 44.3% fewer accidents in a sample of field technicians (N = 393) and 50.6% fewer accidents in a sample of customer service representatives (N = 163). Lemming, Johnson, and Foster (2008) replicated these findings using subjective safety ratings provided by supervisors as criteria.

J. Hogan (2005) examined a set of profiles for three organizations with multiple safety criteria. Supporting the inclusion of the selected scales, each profile demonstrated similar results regardless of industry or criteria. Specifically, the high safety group had higher average scores on the HPI Adjustment, Prudence, and Interpersonal Sensitivity scales as compared to the low safety group. Also, Sociability proved an important component of safety for truck drivers, with highly sociable drivers performing poorly compared to less social drivers.

This research shows that organizations can use combinations of personality scales to predict workplace safety. Stuhlmacher et al. (2009) suggested this approach, but provided no data to support the predictiveness of scale combinations.

3.2 Structure

Hogan developed the safety competency model using an expert review of safety predictors and empirical evidence from previous research. We developed the model to generalize across organizations by identifying competencies that defined safety behaviors across industries and jobs. These competencies include: (a) following standard operating procedures (Compliant), (b) handling stress (Strong), (c) maintaining emotional control (Emotionally Stable), (d) focusing attention over time

(Vigilant), (e) avoiding unnecessary risks over time (Cautious), and (f) engaging in training and development opportunities (Trainable). The safety competencies and their descriptions appear in Table 3.1.

Table 3.1
Safety Competencies and Descriptions

Competency	Description
Compliant	A person's tendency to follow rules. Poor performers ignore authority and company rules. Exceptional performers willingly follow rules and guidelines.
Strong	A person's ability to handle stress with confidence. Poor performers tend to panic under pressure and make mistakes. Exceptional performers are steady under pressure.
Emotionally Stable	A person's ability to handle pressure without emotional outbursts. Poor performers easily lose their tempers and then make mistakes. Exceptional performers control their tempers.
Vigilant	A person's ability to stay focused when performing monotonous tasks. Poor performers are easily distracted and then make mistakes. Exceptional performers stay focused on the task at hand.
Cautious	A person's tendency to avoid risk. Poor performers tend to take unnecessary risks. Exceptional performers evaluate their options before making risky decisions.
Trainable	A person's tendency to respond favorably to training. Poor performers overestimate their competence and are hard to train. Exceptional performers listen to advice and like to learn.

3.3 Constructing Facet-level Personality Scales for Predicting Safety Competencies

Combinations of narrow personality variables (i.e., HICs) consistently exhibit incremental validity over broad personality factors when predicting a range of work outcomes (Casillas, Robbins, McKinniss, Postlethwaite, & Oh, 2009; J. Hogan & Roberts, 1996; Ones, Dilchert, Viswesvaran, & Judge, 2007; Paunonen, 1998; Paunonen & Ashton, 2001; Paunonen, Haddock, Försterling, & Keinonen, 2003; Paunonen & Nicol, 2001; Tett & Christiansen, 2007). Combining facet-level results across personality scales, therefore, improves the prediction of many competencies. Realizing the value of such an approach, Hough (2001) stated:

What is needed is a database that can be used with synthetic validation models to build prediction equations for specific situations. First, however, I/O psychologists need research data to provide information about the relationships between predictor constructs and the criterion constructs... (p. 37)

Using data from the Hogan archive (Hogan Assessment Systems, 2010), which contains information from over 250 criterion-related validity studies conducted over the last 30 years, we developed facet-level personality scales to maximize the prediction of safety and general employability competencies in the Hogan Safety Report.

3.4 Research Approach and Rationale

To develop final facet-level scales, we identified HICs with both theoretical and empirical safety relationships. The theoretical approach relied on expert judgment to identify personality constructs that predict safety-related competency performance. The empirical approach relied on job performance data in the Hogan archive to forecast each competency. We developed facet-level safety scales using two studies.

In Study 1, we identified personality facets relating to each of the six dimensions of the safety competency model. First, we identified studies in the Hogan archive containing criterion data relating to each of the six safety competencies. Next, we identified HICs associated with each criterion. Finally, we developed and examined the predictive validity of the new facet-level safety scales for predicting aligned competency ratings. In Study 2, we examined relationships between Study 1 facet-level algorithms and overall safety performance ratings. Subsequently, we examined the utility of the six safety scales with hit rates for accidents and injuries.

4. STUDY 1: DEVELOPMENT OF FACET-LEVEL PERSONALITY SCALES ASSOCIATED WITH SAFETY COMPETENCIES

4.1 Scale Development

The first step to develop facet-level safety scales involved creating scoring algorithms to predict each of the six safety competencies. Development of predictive algorithms requires a balanced, parallel approach of qualitative, expert judgment and quantitative, empirical analyses.

The Hogan archive provided data for establishing empirical links between personality facets and each safety competency. First, we identified studies containing both HPI and performance data for each safety competency. Second, we correlated HIC scores and performance measures. Finally, we aggregated these results across studies. An expert panel with over 60 years of combined experience using the HPI to forecast job performance completed these steps.

As seen in Table 4.1, we linked each safety competency to no fewer than 5 and no more than 9 core HICs. Core HICs represent the most predictive facets for each safety competency while minimizing overlap. Appendix A presents the standard HPI and Safety Report HIC names (see Table A1).

Table 4.1 HPI HICs Mapped to Safety Competencies

HPI Scale		S	Safety Competencies						
FFM Dimension	FFM Dimension HPI Facet			3	4	5	6		
Adjustment	Empathy								
Neuroticism	Not Anxious		Χ	Χ					
	No Guilt		Χ	Χ					
	Calmness			Χ	Χ				
	Even Tempered			Χ					
	No Complaints								
	Trusting								
	Good Attachment						Χ		
Ambition	Competitive		Χ				Χ		
Extraversion	Self Confident		Χ						
	Accomplishment								
	Leadership		Χ						
	Identity								
	No Social Anxiety					R			

18

Table 4.1 cont.
HPI HICs Mapped to Safety Competencies

HPI Scale			Safety Competencies						
FFM Dimension	HPI Facet		L	2	3	4	5	6	
Sociability	Likes Parties					R		R	
Extraversion	Likes Crowds					R	R	R	
	Experience Seeking	F	₹				R		
	Exhibitionistic	F	₹		R				
	Entertaining	F	₹			R	R		
Interpersonal Sensitivity	Easy to Live With								
Agreeableness	Sensitive								
	Caring								
	Likes People								
	No Hostility	>	(Χ				
Prudence	Moralistic)	(
Conscientiousness	Mastery							Χ	
	Virtuous								
	Not Autonomous								
	Not Spontaneous						Χ		
	Impulse Control				Χ		Χ		
	Avoids Trouble	>	<					Χ	
Inquisitive	Science								
Intellect/Openness	Curiosity					R			
	Thrill Seeking								
	Intellectual Games							Χ	
	Generates Ideas					R			
	Culture							Χ	
Learning Approach	Good Memory							Χ	
Intellect/Openness	Education								
	Math Ability								
	Reading								

Note. Safety Competencies: 1 = Compliant; 2 = Strong; 3 = Emotionally Stable; 4 = Vigilant; 5 = Cautious; 6 = Trainable; X = Selected HIC; R = Reverse scored selected HIC.

4.2 Method

Hogan used meta-analysis to examine the predictive validity of each algorithm. Meta-analysis averages findings from multiple studies to examine relationships between similar variables. The procedure controls for error due to sampling, measurement, range restriction, and potential moderating variables and provides a best estimate of these relationships across jobs and organizations (Smith & Glass, 1977).

We used meta-analysis procedures outlined by Hunter and Schmidt (2004), who argue that differences in an assessment's validity across studies reflect statistical artifacts (e.g., sampling deficiency) and measurement problems (e.g., predictor/criterion unreliability, range restriction) rather than other characteristics unique to specific jobs or situations. These procedures demonstrate that correlations between performance measures and cognitive ability tests (Schmidt & Hunter, 1977), biographical data inventories (Schmidt & Rothstein, 1994), personality inventories (Barrick & Mount, 1991; Barrick, Mount, & Gupta, 2003; J. Hogan & Holland, 2003; Hough, 1992; Judge, Bono, Ilies, & Gerhardt, 2002; Salgado, 1997, 1998; Tett, Jackson, & Rothstein, 1991), assessment center exercises (Arthur, Day, McNelly, & Edens, 2003; Gaugler, Rosenthal, Thornton, & Benson, 1987), and situational judgment tests (McDaniel, Morgeson, Finnegan, Campion, & Braverman, 2001) generalize across jobs and organizations.

According to the *Principles*, "reliance on meta-analysis results is more straightforward when they are organized around a construct or set of constructs" (SIOP, 2003, p. 30). Schmidt and Hunter (1977) used a construct orientation in their well-known meta-analysis of cognitive ability measures. J. Hogan and Holland (2003) did the same using a domain skills model as the basis for a meta-analysis of personality predictor correlations. They showed that personality predicts job performance more strongly than previously reported in studies examining personality and overall job performance. Such a construct driven approach, aligning facets of personality with work-related outcomes, has two advantages. First, theory drives professional judgment, which is unavoidable when compiling data from multiple studies. Second, a theory-driven approach provides a framework for interpreting results.

4.2.1 Case Selection

Hogan used a criterion-centric approach (Bartram, 2005; Campbell, 1990; J. Hogan & Holland, 2003; Hough, 1992; Hurtz & Donovan, 2000) to develop facet-level scoring algorithms for each component of the safety competency model. Case selection began with a search of the Hogan archive to identify studies with criterion measures relating to each safety competency. Studies had to (a) include job analysis information, (b) contain HPI HIC-level data, (c) use a concurrent or predictive validation strategy, and (d) contain criterion data whose content reflected one of the competencies. We excluded studies if they (a) were not conducted with the assistance of a researcher trained in test validation, (b) contained only self-report criterion data, or (c) were unrelated to work contexts (e.g., student performance). Once we selected cases, a panel of experts categorized the performance criteria for each study into one of the six safety competencies and achieved 100% agreement.

20

4.2.2 Job Analysis

Studies included in our sample used some type of job analysis as part of the initial criterion-related validation. Most studies used the Job Evaluation Tool (JET; Hogan Assessment Systems, 2000). Hogan designed the JET to identify critical personal requirements and competencies needed for effective performance. A copy of the Competency Evaluation Tool (CET; Hogan Assessment Systems, 2000), a component of the JET that asks respondents to rate the importance of 56 competencies, appears in Appendix B. Other forms of job analysis included task analysis, job observation, focus groups, critical incidents methods, and interviews with Subject Matter Experts (SMEs).

4.2.3 Meta-Analysis Procedures

Hogan used zero-order product-moment correlations (r) as effect sizes for all studies included in meta-analyses to cumulate results across studies. As recommended by Hunter and Schmidt (2004), we used a random-effects model, allowing the population parameter to vary across studies. This model provides for the possibility that relationships between variables may vary across jobs and organizations. This feature is in contrast to a fixed-effects model, which assumes the relationships between variables are consistent across all possible situations (Hunter & Schmidt, 2004). Although both random-effects and fixed-effects models allow for the computation of confidence intervals, only random-effects models allow researchers to present credibility intervals. Confidence intervals may be interpreted to indicate the statistical significance of the relationships between variables across jobs and organizations whereas credibility intervals estimate the variability of those relationships across settings after sources of measurement error and bias are removed. That is, confidence intervals estimate the statistical significance of the relationships between variables across jobs and organizations. If the lower bound of a 95% confidence interval does not include zero, there is less than a 5% chance that the results of the meta-analysis are due to chance. Credibility intervals estimate the variability of results across studies. If the lower bound of an 80% credibility interval does not include zero, more than 90% of the results across situations will be in the expected direction (i.e., will have positive correlations). In other words, confidence intervals estimate the accuracy of the relationships between variables, and credibility intervals estimate the variability in results across jobs and organizations.

Although some researchers (e.g., Murphy & DeShon, 2000) argue against using rater-based reliability estimates, we followed procedures used in several benchmark personality-based meta-analyses (Barrick & Mount, 1991; Tett et al., 1991) and used the .508 reliability coefficient proposed by Rothstein (1990) to estimate the reliability of supervisors' competency performance ratings. We note that other values could be used, although more recent estimates (e.g., Viswesvaran, Schmidt, & Ones, 2005) have produced similar results. Furthermore, we know of no studies examining

reliability estimates specific to safety ratings. Lack of reliability attenuates correlations between predictors and job performance measures. Correcting for unreliability in the criteria estimates *operational validity*, or the relationships between scores produced from the facet-level scoring algorithms and safety competency ratings. We examined range restriction for the predictors across studies and found that range restriction corrections had negligible effects. Therefore, to use personality measures to predict safety behaviors, we only corrected for criterion unreliability. This correction increased estimated population parameters by a factor of 1.41 (i.e., sample weighted average correlations were approximately 71% of the corrected size). Furthermore, Hunter and Schmidt (2004) state that meta-analytic results can be biased unless each sample contributes approximately the same number of correlations to the analysis. To eliminate such bias, we used only one criterion measure per study to represent each safety competency. Note that this procedure uses both negative and positive correlations rather than mean absolute values for averaging correlations.

4.3 Results

Table 4.2 presents the relationships between scores for each facet-level scoring algorithm and respective measures of safety competencies. As seen in this table, we identified at least 17 studies containing criterion data for all components of the safety model. These studies included between 1,674 and 4,689 participants. As seen, the lower bounds for confidence and credibility intervals do not include zero for any scale-competency relations. Because the lower limits of both the 95% confidence interval and 80% credibility interval for each scale are well above zero, these results show the predictor-criterion relations are significant and can be expected to generalize to future samples.

All observed validities are equal to or above $\rho=.21$; the strongest relationship is between the Strong facet-level scale and panic-strong competency ratings, which reflect the ability to handle stress and perform under pressure ($\rho=.29$, k=23, N=2,305). The weakest effect is for the Trainable facet-level scale and ratings for training and paying attention to training feedback ($\rho=.21$, k=23, N=1,710). All six facet-level scales significantly predict criteria aligned with a competency that contributes, conceptually, to safe behavior. Based on this alignment, we now refer to the facet-level scales as safety scales.

Table 4.2

Meta-Analysis Estimates of Safety Scales for Predicting Aligned Safety Competency Ratings

Safety Scale	k	N	Rsw	SDsw	ρ	SDp	% Var	80% CV	95% CI
Compliant	42	3,782	.16	.09	.22	.13	100%	.16	.12
Strong	23	2,305	.20	.08	.29	.11	100%	.20	.16
Emotionally Stable	46	4,689	.19	.10	.26	.15	84%	.14	.16
Vigilant	17	1,674	.15	.10	.22	.14	98%	.15	.11
Cautious	32	3,814	.16	.09	.23	.12	100%	.16	.13
Trainable	23	1,710	.15	.06	.21	.09	100%	.15	.11

Note. Results corrected for criterion unreliability. k = Number of correlations; N = Sample size; R_{sw} = Sample-weighted mean correlation; SD_{sw} = Sample-weighted standard deviation; ρ = Operational validity; SD_p = Standard deviation of the corrected population correlation; % Var = Percent of variance accounted for by sampling error and artifact corrections; 80% CV = lower 10% boundary of 80% Credibility interval; 95% CI = lower 2.5% boundary of 95% Confidence interval.

5. STUDY 2: VALIDATION OF SAFETY SCALES

Chapter 4 describes the development and validation of six safety scales that model the dispositional characteristics associated with safety competency ratings. In this chapter, we use independent samples to show that the six safety scales are valid predictors of overall safety performance ratings. Also, because there is some debate about the value of occupationally specific content scales versus the standard FFM scales, we show that the safety scales outperform the standard FFM scales for predicting overall safety performance. The safety scales are not independent, but their interrelations are meaningful. In addition, they show interpretable correlations with scales from other well-validated personality inventories.

5.1 Validation Methods

We identified samples independent of those we used for developing the safety scales to examine relationships between the scales and overall safety performance measures. We used the same approach as outlined in Chapter 4 to examine relationships between the predictor scales and overall safety performance ratings, with two exceptions. For these independent analyses, samples (a) had to include supervisory ratings of overall safety performance and (b) could not be included in the previous analyses to develop the safety scales.

5.2 Results for Meta-Analysis of Safety Scales

We used zero-order product-moment correlations (r) as effect sizes for all studies, a random-effects model of meta-analysis, and computed 95% confidence intervals and 80% credibility intervals for each meta-analysis. We used a reliability coefficient of .508 to correct for criterion unreliability. As seen in Table 5.1, operational validities for the safety scales ranged from .15 to .28 (k = 5, N = 317 to 322). The highest operational validity is for the Compliant scale, whereas the lowest validities are for the Cautious and Strong scales (ρ = .15 and ρ = .16, respectively). Although the lower bound of both the 95% confidence interval and the 80% credibility interval included zero for two of the six safety scales (Vigilant and Cautious), credibility intervals indicate that one or more moderators affect these relationships.

Table 5.1

Meta-Analysis Estimates of Safety Scales and Broad HPI Scales for Predicting Overall Safety
Performance Ratings

Personality Scale	k	N	Rsw	SDsw	ρ	% Var	80% CV	95% CI
Compliant	5	322	.20	.12	.28	100%	.20	.09
Strong	5	319	.11	.08	.16	100%	.11	.04
Emotionally Stable	5	320	.14	.09	.20	100%	.14	.06
Vigilant	5	319	.14	.18	.20	44%	.00	02
Cautious	5	319	.11	.17	.15	50%	01	05
Trainable	5	317	.17	.07	.24	100%	.17	.11
HPI Adjustment	5	322	.08	.04	.11	100%	.08	03
HPI Ambition	5	320	.04	.12	.05	98%	.04	07
HPI Sociability	5	322	16	.14	22	77%	11	05
HPI Interpersonal Sensitivity	5	322	.05	.05	.07	100%	.05	06
HPI Prudence	5	322	.11	.11	.15	100%	.11	.00
HPI Inquisitive	5	322	.01	.15	.02	71%	07	10
HPI Learning Approach	5	322	.06	.11	.08	100%	.06	05

Note. Results corrected for predictor and criterion unreliability. k = Number of correlations; N = Sample size; $R_{\rm SW}$ = Sample-weighted mean correlation; $SD_{\rm SW}$ = Sample-weighted standard deviation; ρ = Operational validity; SD_p = Standard deviation of the corrected population correlation; % Var = Percent of variance accounted for by sampling error and artifact corrections; 80% CV = lower 10% boundary of 80% Credibility interval; 95% CI = lower 2.5% boundary of 95% Confidence interval.

With one exception, the safety scales in Table 5.1 outperformed the HPI standard scales in predicting overall safety performance ratings. The two standard scales that relate most logically to safety, in fact, were more valid than the other FFM measures. These were HPI Sociability (FFM Extraversion; ρ = -.22) and HPI Prudence (FFM Conscientiousness; ρ = .15). The negative relation for Sociability reflects the fact that employees who are impulsive, talkative, reluctant to listen, and distractible are evaluated as unsafe workers. The positive relation for Prudence reflects the fact that employees who are compliant, planful, and self-controlled are evaluated as safe workers, when these characteristics impact their performance. The remaining broad FFM construct measures appear to be irrelevant for predicting overall safety performance.

Combined with the HICs chosen to predict each safety competency (Table 4.1), these results suggest the following regarding the personality facets and components of the safety competency model:

- Compliant: Analyzing the Experience Seeking (Sociability), Exhibitionistic
 (Sociability), Entertaining (Sociability), No Hostility (Interpersonal Sensitivity),
 Moralistic (Prudence), and Avoids Trouble (Prudence) HIC data from 322
 participants across five criterion-related validity studies resulted in an operational
 validity of .28. In general, individuals with high scores will conform to
 organizational guidelines. They will be less likely than individuals with low scores
 to defy organizational authorities or ignore company rules.
- Strong: Analyzing the Not Anxious (Adjustment), No Guilt (Adjustment),
 Competitive (Ambition), Self Confident (Ambition), and Leadership (Ambition) HIC
 data from 319 participants across five criterion-related validity studies resulted in
 an operational validity of .16. In general, individuals with high scores will exhibit
 confidence in their work. They will be less likely than individuals with low scores
 to make mistakes because of panicking under pressure.
- Emotionally Stable: Analyzing the Not Anxious (Adjustment), No Guilt
 (Adjustment), Calmness (Adjustment), Even Tempered (Adjustment),
 Exhibitionistic (Sociability), No Hostility (Interpersonal Sensitivity), and Impulse
 Control (Prudence) HIC data from 320 participants across five criterion-related
 validity study resulted in an operational validity of .20. In general, individuals
 with high scores will display emotional control while working. They will be less
 likely than individuals with low scores to make mistakes because of losing their
 tempers.
- Vigilant: Analyzing the Calmness (Adjustment), Likes Parties (Sociability), Likes
 Crowds (Sociability), Entertaining (Sociability), Curiosity (Inquisitive), and
 Generates Ideas (Inquisitive) HIC data from 319 participants across five criterionrelated validity studies resulted in an operational validity of .20. In general,
 individuals with high scores will remain vigilant while performing repetitive or
 routine work tasks. They will be less likely than individuals with low scores to
 make mistakes because of becoming bored and inattentive.
- Cautious: Analyzing the No Social Anxiety (Ambition), Likes Crowds (Sociability),
 Experience Seeking (Sociability), Entertaining (Sociability), Not Spontaneous
 (Prudence), and Impulse Control (Prudence) HIC data from 319 participants
 across five criterion-related validity studies resulted in an operational validity of
 .15. In general, individuals with high scores will perform work carefully, avoiding
 unnecessary risks. They will be less likely than individuals with low scores to
 make mistakes because of taking excessive risks.
- Trainable: Analyzing the Good Attachment (Adjustment), Competitive (Ambition), Likes Parties (Sociability), Likes Crowds (Sociability), Mastery (Prudence), Avoids Trouble (Prudence), Intellectual Games (Inquisitive), Culture (Inquisitive), and Good Memory (Learning Approach) HIC data from 317 participants across five

criterion-related validity studies resulted in an operational validity of .24. In general, individuals with high scores will remain open to new training and development opportunities. They will be less likely than individuals with low scores to overestimate their own competence and resist training and development opportunities because of their arrogance.

5.3 Construct Validity of the Safety Scales

Table 5.2 presents the correlations between the six safety scales (see Table 4.1 for HIC facets by scale) and test-retest reliabilities for each scale. The scales are neither statistically nor conceptually independent. The highest correlation is between the Vigilant and Cautious scales (r = .77) and the smallest correlation is between the Compliant and Strong scales (r = -.11). This pattern of relations is expected because both Vigilant and Cautious scales include a number of FFM Extraversion facets (high scores on the safety scales reflect Introversion) whereas Compliant and Strong scales contain facets from different FFM dimensions. Test-retest reliabilities ranged from .63 to .72. We computed these correlations between scales using a large international normative dataset (N = 5,785) containing data for both applicants and incumbents in entry-level jobs from over 20 countries. We computed test-retest reliabilities using a sample of 412 individuals who completed the HPI twice over a 1 to 3 year period.

Table 5.2 Intercorrelations between Safety Scales

	COM	STR	ES	VIG	CAU	TRA
Compliant	.71					
Strong	11	.63				
Emotionally Stable	.64	.37	.69			
Vigilant	.53	30	.21	.67		
Cautious	.58	36	.25	.77	.68	
Trainable	.26	.23	.35	.11	.15	.72

Note. All correlations are significant at the .001 level (N = 5,785). Diagonal results (those in italics) represent test-retest reliability results (N = 412). COM = Compliant; STR = Strong; ES = Emotionally Stable; VIG = Vigilant; CAU = Cautious; TRA = Trainable.

Table 5.3 presents correlations between the safety scales and five personality inventories used in applied psychology. These data are from the Eugene-Springfield community archive samples recruited and maintained by the Oregon Research Institute (Goldberg, 2008). The data presented here include the HPI (R. Hogan & J. Hogan, 2007; scored for the safety scales), the International Personality Item Pool (IPIP; Goldberg, 1999), the NEO PI-R (Costa & McCrae, 1992), the 16 Personality Factor Questionnaire (16PF; Conn & Rieke, 1994), the California Personality Inventory (CPI; Gough & Bradley, 1996), and the Jackson Personality Inventory-Revised (JPI-R, Jackson, 1994). The convergent and discriminant relations between

the personality scales provide further evidence for the construct validity of the safety scales. We expect correlations between similar construct measures to be significantly larger than correlations between dissimilar constructs. As seen in Table 5.3, the correlations between the safety scales and similar construct measures from well-validated personality inventories converge.

Because facet scales necessarily combine item composites from different FFM scales, they are not "pure" factor measures. Although this scale construction strategy dilutes construct validity, we can identify construct saturation and content themes using other scales as a benchmark. For example, the Compliant safety scale is saturated with negative FFM Extraversion. Note the Compliant scale has significant relations with IPIP Extraversion (r = -.34), NEO PI-R Excitement Seeking (r = -.25), 16PF Liveliness (r = -.40), CPI Sociability and Self-Control (r = -.35 and r = .53, respectively), and JPI-R Social Confidence (r = -.34). Working between Table 4.1, to understand the construct composition and FFM saturation of each safety scale, and Table 5.3, with zero-order correlations for various measures, scale convergences and interpretations become possible. A few additional example results are worth noting.

The Strong scale concerns being resilient under pressure while demonstrating leaderlike behavior. The pattern of correlations with other measures confirms this interpretation. In particular, note correlations with the NEO PI-R Anxiety and Competence facets (r = -.54 and r = .55), 16PF Emotional Stability and Apprehension scales (r = .57 and r = .44), and CPI Dominance and Well Being scales (r = .56 and r= .56). The Emotional Stability safety scale correlates with all of the Emotional Stability markers in Table 5.3. The Vigilant safety scale concerns staying focused and not being easily distracted. This scale can be interpreted by what it is not. We see negative correlations between Vigilant and IPIP Extraversion (r = -.51), NEO PI-R Gregariousness (r = -.50), 16PF Liveliness (r = -.50), CPI Sociability (r = -.53), and JPI-R Innovation (r = -.43). The Cautious safety scale contrasts risk taking with risk aversion. Correlations include IPIP Extraversion (r = -.51), NEO PI-R Assertiveness (r= -.35), 16PF Social-Boldness (r = -.49), and JPI-R Risk Taking (r = -.47). The Trainable safety scale reflects a willingness to accept training; it is the only scale that correlates with FFM Openness construct measures. In particular, note the correlations with IPIP Intellect (r = .32), NEO PI-R Ideas (r = .31), 16PF Reasoning (r = .31) .21), and CPI Intellectual Efficiency (r = .28). In terms of discriminant validity, FFM Agreeableness is unrelated to the safety scales, indicating that friendly relations with others is not part of the safety model.

Table 5.3
Correlations between Safety Scales and FFM and Selected Personality Inventory Scales

	Compliant	Strong	Emotionally Stable	Vigilant	Cautious	Trainable
IPIP Big 5 20-Item Scales (N = 131)						
Extraversion	34**	.37**	16	51**	51**	17
Agreeableness	.04	.13	.12	25**	20*	.09
Conscientiousness	.01	.33**	.16	04	02	.20*
Emotional Stability	.39**	.41**	.67**	.05	.00	.22*
Intellect/Imagination	32**	.21*	.04	36**	27**	.32**
NEO PI-R Scales/Facets (N = 152)						
Neuroticism	23**	61**	57**	.09	.09	25**
Anxiety Facet	18*	54**	47**	.05	.15	18*
Angry Hostility Facet	37**	23**	58**	03	01	24**
Depression Facet	17*	57**	48**	.09	.09	19*
Self-Consciousness Facet	.01	52**	29**	.17*	.14	15
Impulsiveness Facet	23**	39**	39**	.01	01	18*
Vulnerability Facet	15	62**	44**	.11	.07	21**
Extraversion	26**	.44**	03	49**	52**	10
Warmth Facet	02	.07	.09	29**	29**	10
Gregariousness Facet	17*	.24**	10	50**	42**	23**
Assertiveness Facet	23**	.44**	06	29**	35**	.04
Activity Facet	23**	.35**	05	25**	27**	.05
Excitement-Seeking Facet	25**	.22**	15	28**	34**	15
Positive Emotions Facet	07	.30**	.14	20*	27**	.02
Openness	27**	09	09	23**	19*	.21*
Fantasy Facet	23**	20*	13	15	13	.04
Aesthetics Facet	17*	10	02	17*	10	.19*
Feelings Facet	29**	07	23**	20*	21**	.08
Actions Facet	16*	.05	.05	19*	30**	.18*
Ideas Facet	26**	.10	02	23**	13	.31**
Values Facet	03	11	06	06	01	.06
Agreeableness	.49**	13	.38**	.17*	.20*	.10
Trust Facet	.35**	.22**	.39**	.01	01	.13

Table 5.3 cont.

Correlations between Safety Scales and FFM and Selected Personality Inventory Scales

	0	01	Emotionally	N.C. attacks	0	T
	Compliant	Strong	Stable	Vigilant	Cautious	Trainable
NEO PI-R Scales/Facets (N = 152)						
Straightforwardness Facet	.41**	09	.28**	.30**	.29**	.12
Altruism Facet	.23**	.07	.24**	09	01	.06
Compliance Facet	.43**	15	.41**	.14	.17*	.09
Modesty Facet	.30**	30**	.12	.24**	.25**	01
Tender-Mindedness Facet	.13	24**	.03	.04	.07	.02
Conscientiousness	.08	.51**	.28**	06	.01	.31**
Competence Facet	.13	.55**	.34**	06	.00	.33**
Order Facet	01	.32**	.10	12	05	.09
Dutifulness Facet	.12	.26**	.19*	.05	.09	.22**
Achievement Striving Facet	14	.51**	.11	21*	18*	.23**
Self-Discipline Facet	.08	.51**	.30**	.02	.05	.26**
Deliberation Facet	.23**	.18*	.30**	.07	.20*	.33**
16PF Scales						
(N = 157)						
Warmth	01	.02	09	16*	20*	19*
Reasoning	22**	.05	06	06	08	.21**
Emotional Stability	.20*	.57**	.47**	10	17*	.16*
Dominance	39**	.41**	30**	33**	32**	10
Liveliness	40**	.10	21**	50**	47**	34**
Rule-Consciousness	.18*	.16*	.28**	.12	.06	.10
Social-Boldness	25**	.31**	11	45**	49**	16
Sensitivity	04	37**	17*	.06	.07	03
Vigilance	15	20*	29**	.13	.15	10
Abstractedness	32**	19*	25**	14	12	.06
Privateness	.10	.08	.16*	.27**	.26**	.29**
Apprehension	10	44**	.40**	.11	.12	16*
Openness to Change	26**	.02	12	25**	25**	.16*
Self-Reliance	.06	24**	.00	.34**	.30**	.14
Perfectionism	01	.16	01	04	.00	.08
Tension	29**	14	45**	.11	.14	03

Table 5.3 cont.

Correlations between Safety Scales and FFM and Selected Personality Inventory Scales

	Compliant	Strong	Emotionally Stable	Vigilant	Cautious	Trainable
CPI Scales (N = 160)						
Dominance	30**	.56**	01	33**	39**	.05
Capacity for Status	24**	.36**	.06	44**	43**	.03
Sociability	35**	.43**	02	53**	50**	02
Social Presence	34**	.44**	.02	40**	44**	04
Self-Acceptance	38**	.48**	07	43**	45**	01
Independence	10	.50**	.23**	08	15	.20*
Empathy	30**	.32**	.06	42**	44**	.00
Responsibility	.10	.30**	.27**	.02	02	.39**
Socialization	.42**	.31**	.48**	.18*	.20*	.37**
Self-Control	.53**	.17*	.59**	.31**	.30**	.33**
Good Impression	.38**	.28**	.54**	.09	.11	.23**
Communality	04	.44**	.12	09	15	.12
Well-Being	.22**	.56**	.54**	04	05	.28**
Tolerance	.12	.22**	.28**	.00	.01	.20**
Achievement via Conformance	.03	.49**	.31**	14	17*	.39**
Achievement via Independence	18*	.30**	.13	20**	16*	.21**
Intellectual Efficiency	15	.36**	.17*	20*	23**	.28**
Psychological- Mindedness	14	.36**	.21**	11	09	.24**
Flexibility	16*	09	01	12	13	.01
Femininity/ Masculinity	.11	41**	17*	.21**	.23**	.02
Externality/ Internality	.51**	43**	.23**	.51**	.53**	.12
Norm-Doubting/Norm- Favoring	.25**	.31**	.29**	.06	.10	.31**
Ego-Integration	02	.33**	.30**	15	19*	.23**
JPI-R Scales (N = 167)						
Analytical Cluster						
Complexity	25**	03	11	19*	08	.21**
Breadth of Interest	28**	.10	07	34**	31**	.16*
Innovation	34**	.23**	06	43**	38**	.20**
Tolerance	.03	.07	.19*	20**	17*	.14

Table 5.3 cont.

Correlations between Safety Scales and FFM and Selected Personality Inventory Scales

	,			,	,	
	Compliant	Strong	Emotionally Stable	Vigilant	Cautious	Trainable
JPI-R Scales (N = 167)						
Emotional Cluster						
Empathy	14	18*	28**	12	09	08
Anxiety	27**	42**	59**	09	.00	20**
Cooperativeness	.02	14	11	05	01	15
Extroverted Cluster						
Sociability	21**	.16*	17*	44**	35**	14
Social Confidence	34**	.50**	08	47**	49**	.00
Energy Level	11	.50**	.14	25**	27**	.19*
Opportunistic Cluster						
Social Astuteness	10	.11	08	25**	24**	07
Risk Taking	37**	.27**	19*	33**	47**	09
Dependable Cluster						
Organization	.14	.33**	.16*	.07	.17*	.22**
Traditional Values	.21**	.08	.16*	.15	.13	.03
Responsibility	.20*	.14	.17*	.12	.08	.26**

^{*}p < .05. **p < .01.

5.4 Averaged Safety Scale Results

To examine the predictive validity of the complete safety competency model, we examined correlations between average scores on the six safety scales with supervisors' overall safety ratings and meta-analyzed results across five studies described in section 5.2. Table 5.4 presents these results.

Table 5.4 Validity Results for Safety Competency Model

	k	N	$R_{\sf sw}$	SD_{sw}	ρ	SD_p	% Var	80% CV	95% CI
Averaged Safety Results	5	322	.23	.13	.32	.19	76%	.19	.11

Note. Results corrected for predictor and criterion unreliability. k = Number of correlations; N = Sample size; R_{sw} = Sample-weighted mean correlation; SD_{sw} = Sample-weighted standard deviation; ρ = Operational validity; SD_{p} = Standard deviation of the corrected population correlation; % Var = Percent of variance accounted for by sampling error and artifact corrections; 80% CV = lower 10% boundary of 80% Credibility interval; 95% CI = lower 2.5% boundary of 95% Confidence interval.

The lower bound of the 95% confidence interval is above zero, indicating that aggregated scores across the six safety scales are significantly correlated with supervisors' overall safety ratings. Furthermore, the lower bound of the 80% credibility interval is above zero, indicating that these results should generalize across jobs and organizations.

In summary, by conducting validity analyses for each safety scale, we demonstrate that each competency in the safety model predicts supervisors' overall safety ratings. Second, we show that an aggregate of the six safety scale scores serves as a better predictor of supervisors' overall safety ratings than any individual safety scale.

5.5 Summary of Studies 1 and 2

Study 1 describes the development and validation of six personality facet-level scales that model the dispositional characteristics associated with safety performance. The scales align with content associated with safety behavior. These behaviors include (a) following rules, (b) being steady under pressure, (c) controlling emotions, (d) being vigilant, (e) avoiding risk, and (f) attending to training and feedback. We selected facets from the HPI that align with these safety behaviors, and, using meta-analysis, evaluated their relations with their respective performance ratings. The results indicate that the safety scales significantly predict the intended safety competency behaviors and these relations generalize across samples, jobs, and industries.

In Study 2, we used independent samples to show that the six safety scales are valid predictors of overall safety performance ratings. As a group, the safety scales outperformed the standard FFM scales for predicting overall safety performance. The safety scales are not independent, but their interrelations are meaningful. In addition, they show interpretable correlations with scales from other well-validated personality inventories, providing support for their construct validity. The operational validity of using all six scales exceeds the validity of using any one single safety scale.

6. GENERAL EMPLOYABILITY SCALES

Safety is only one critical aspect of many occupations. For any job, there are numerous other important performance components such as task performance, adaptability, and positive interactions with others. To remain competitive, organizations must focus on maintaining alignment between their broader performance goals and the capabilities of incoming personnel. To this end, we created the Hogan Advantage. The *Hogan Advantage Technical Manual* (Hogan Assessment Systems, 2009b) describes the development and validation of three general employability scales: Dependability, Composure, and Customer Focus. In this chapter, we summarize components of this manual because users of the safety scales may be interested in a broader scope of employability.

6.1 General Employability Scales

In creating the Hogan Advantage, we first identified the competencies most critical for success across entry-level jobs (Hogan Assessment Systems, 2009b). To identify competencies, we relied on published research outlining critical work components across entry-level jobs and archival data from the CET, which asks SMEs to indicate the extent to which each of 56 listed competencies relates to successful performance in the job or job family under study. Raters evaluate each competency using a 5-point scale ranging from 0 (*Not associated with job performance*) to 4 (*Critical for job performance*). Generally, competencies considered critical are those that receive mean ratings greater than 3 (*Important for job performance*). SME ratings provide a basis for developing structural models to compare job domains and competencies across jobs and within and across job families (J. Hogan, Davies, & R. Hogan, 2007). The CET appears in Appendix B.

We identified three CET competencies that (a) received significant attention in previous research examining critical performance in entry-level jobs and (b) were rated as *Important for job performance* or *Critical for job performance* for entry-level jobs by at least 75% of respondents. These competencies aligned with Dependability, Composure, and Customer Focus.

We define Dependability as the degree to which a person will follow established rules and procedures, make work and work-related activity a priority, accept supervision, and follow through on assigned tasks and responsibilities. Persons with high scores on Dependability tend to be hard working and reliable. Persons with low scores are more likely to be careless, uneven in their job performance, and rebellious or insubordinate.

We define Composure as the degree to which an employee can handle stress and pressure without becoming upset or emotional. Persons with high scores on Composure tend to remain calm, relaxed, and focused on their job even under pressure. Persons with low scores are more likely to become visually upset. They tend to become easily frustrated, nervous, and irritable, requiring extra attention and reassurance.

We define Customer Focus as a person's capacity to relate to clients or customers, who may be either internal or external to an organization, in a friendly, positive, and helpful manner. Persons with high scores on Customer Focus will listen effectively to customers' questions and problems, and are polite, patient, attentive, and helpful. Persons with low scores are more likely to be irritable, impatient, or rude when responding to customers' concerns, often making it difficult to resolve problems effectively.

6.2 Validity of the General Employability Scales

Hogan developed the Hogan Advantage scales using the same methods described in Chapter 4 for the initial development of the safety scales. Table 6.1 presents the relationships between scores for each competency-based scoring algorithm and respective measures of rated job performance across multiple studies in the Hogan archive. We identified at least 12 studies containing criterion data for each competency. These studies included between 1,282 and 2,855 participants.

Table 6.1
Validity Results for Competency Algorithms

Competency	k	N	Rsw	SDsw	ρ	SDp	% Var	80% CV	95% CI
Dependability	12	1,282	.20	.09	.28	.13	99%	.20	.15
Composure	17	2,855	.19	.08	.27	.11	93%	.18	.16
Customer Focus	12	1,357	.26	.13	.36	.19	44%	.14	.18

Note. Results corrected for predictor and criterion unreliability. k = Number of correlations; N = Sample size; $R_{\rm SW}$ = Sample-weighted mean correlation; $SD_{\rm SW}$ = Sample-weighted standard deviation; ρ = Operational validity; SD_p = Standard deviation of the corrected population correlation; % Var = Percent of variance accounted for by sampling error and artifact corrections; 80% CV = lower 10% boundary of 80% Credibility interval; 95% CI = lower 2.5% boundary of 95% Confidence interval.

Table 6.1 shows that the lower bounds for credibility intervals and confidence intervals do not include zero for any general employability competency. Because over 90% of all samples produce positive results for each algorithm, and each algorithm produces scores significantly related to components of the entry-level competency model, these results support implementing the general employability scoring algorithms.

6.3 Cross Validation

When we developed the Hogan Advantage scales to predict specific areas commonly associated with performance in entry-level jobs, we expected that an average score across the three scales would predict overall job performance. To test this hypothesis, we identified cross-validation samples in the Hogan archive. These samples were not used as part of the initial development or validation of the three scales. Studies had to (a) include job analysis information, (b) contain HPI HIC-level data, (c) use a concurrent or predictive validation strategy, (d) contain criterion data explicit to overall job performance, and (e) represent one or more entry-level jobs. We excluded studies if they (a) were not conducted with the assistance of a researcher trained in test validation, (b) contained only self-report criterion data, or (c) were unrelated to work contexts (e.g., student performance).

We identified five studies in the Hogan archive that met these criteria. These studies contain predictor data and supervisors' ratings of overall job performance for 405 individuals. Jobs varied across studies, with most studies including more than one entry-level job. Industry sectors represented in these studies included manufacturing, transportation, and construction.

Using the same meta-analysis methods described in Chapter 4, we examined correlations between average scores on the three general employability scales and measures of overall job performance. Table 6.2 presents these results.

Table 6.2
Validity Results for Average Scale Score and Overall Job Performance

	k	N	$R_{\sf sw}$	SD_{sw}	ρ	SD_p	% Var	80% CV	95% CI
Average Score	5	405	.22	.10	.30	.14	100%	.22	.13

Note. Results corrected for predictor and criterion unreliability. k = Number of correlations; N = Sample size; $R_{\rm Sw}$ = Sample-weighted mean correlation; $SD_{\rm Sw}$ = Sample-weighted standard deviation; ρ = Operational validity; SD_p = Standard deviation of the corrected population correlation; % Var = Percent of variance accounted for by sampling error and artifact corrections; 80% CV = lower 10% boundary of 80% Credibility interval; 95% CI = lower 2.5% boundary of 95% Confidence interval.

The sample-weighted mean correlation was .22, which exceeds most results previously found between any individual personality scale and measures of overall job performance. The lower bound of the 80% credibility interval does not contain zero, suggesting that this result is consistent across the entry-level jobs used as cross-validation samples. Furthermore, the lower bound of the 95% confidence interval does not contain zero, indicating that the result is statistically significant.

Analyses indicated little range restriction in the five samples examined relative to the normative dataset for the HPI (R. Hogan & J. Hogan, 2007). Therefore, we only corrected results for unreliability in criteria. The resulting operational validity estimate was .30. Again, this result surpasses most results previously reported between individual personality scales and overall job performance.

7. THE UTILITY AND VALIDITY OF SAFETY SCALES FOR OBJECTIVE WORK OUTCOMES

The results presented in Chapter 5 support the use of the safety scales in the Safety Report for predicting supervisors' subjective ratings of safety. However, some individuals who exhibit unsafe behaviors may avoid accidents for long periods of time while others who exhibit safe behaviors may suffer from unavoidable accidents and injuries. Nevertheless, because certain personality characteristics are associated with higher safety ratings, general trends should illustrate that, over time, individuals who exhibit these characteristics will report a lower incident rate than individuals who do not. Based on this hypothesis, we evaluated the effectiveness of results presented in the Safety Report against real-world, objective safety-related outcomes.

We identified studies in the Hogan archive containing objective, safety-related criterion data. Studies had to (a) include job analysis information, (b) contain HPI HIC-level data, (c) use a concurrent or predictive validation strategy, and (d) contain data on one or more objective measures related to workplace safety. We excluded studies if they (a) were not conducted with the assistance of a researcher trained in test validation, (b) contained only self-report criterion data, or (c) were unrelated to occupational work contexts (e.g., student performance). Seven studies met these criteria.

The diversity of objective safety-related measures available prohibits aggregating results across studies through meta-analysis. Individual organizations vary in how they define and document accidents and injuries, including what constitutes an accident or injury, how they record accidents and injuries, and the degree of severity of those accidents and injuries. Also, work-related characteristics of jobs and the environment in which they are performed vary across organizations. These characteristics influence the types of accidents and injuries organizations record as well as the base rate associated with objective, safety-related work outcomes. Therefore, it is inappropriate to treat all objective variables as indicators of the same type of work-related outcome. In addition, the low base rates often associated with objective safety-related measures reduce the statistical power of most analyses.

Nevertheless, it is useful to examine results in the Safety Report against objective safety measures. We conducted analyses involving the accuracy of classifications for each of the seven samples. In the Safety Report, we use HPI results to calculate scores for each safety scale. For these analyses, we compared safety incident rates across two groups based on the overall algorithm described in Chapter 5, section 5.4. The first group consists of those with above average overall safety scores from the aggregated algorithm. Specifically, this group consisted of individuals whose

scores would, compared to over 12,000 Operations and Trades individuals in the HPI normative sample (R. Hogan & J. Hogan, 2007), fall within the top 50%. The second group had scores falling within the bottom 50%. We calculated differences in safety-related work occurrences across these two groups in each sample.

7.1 Case Study #1

Case Study #1 contained data from 843 employees in a large midwestern freight company. These incumbents occupied several different hourly jobs, primarily associated with loading, transporting, and delivering freight. Tenure for these individuals was at least 1 year. All jobs included components of physical labor, such as heavy lifting and operation of machinery. The criterion variable was accidents reported over the past 3 years.

Participants completed the HPI either prior to or during their employment. We classified participants into above and below average safety score groups based on overall safety scores derived from HPI data. The large sample size allowed us to assess the effects of tenure. We conducted analyses for the total sample, as well as for those whose tenure was 3 years or longer (N = 159).

Base rate analyses revealed that only 5% of the sample reported accidents. A review of the company's reporting procedures indicated that they only documented major accidents or injuries—those resulting in a significant loss either in employee time or in organizational resources. In addition, the majority of the accidents recorded are costly for the organization, with total damages and loss in production often reaching into the hundreds-of-thousands of dollars per accident.

Analyses revealed several important results. For example,

- Overall, employees who appear to panic under pressure (low Strong) were more likely to be involved with at least one major accident than those who tend to remain calm when in stressful situations (high Strong).
- Across the entire sample, individuals with above average overall safety scores recorded 20% fewer major accidents than individuals with below average overall safety scores.
- For employees with at least 3 years tenure, the Cautious scale had the strongest relationship with reported accidents. Specifically, employees who tend to take unnecessary risks (low Cautious) were more likely to have been involved with at least one major accident than employees who appear to assess their options before acting (high Cautious).

 For those on the job for 3 years or longer, individuals with above average overall safety scores reported 50% fewer accidents compared to individuals with below average overall safety scores.

We conducted odds ratio analyses for employees whose tenure is 3 years or longer. These analyses indicate that individuals with below average overall safety scores were twice as likely to have recorded a major accident compared to those with above average overall safety scores. For this organization, these results indicate that using the Safety Report to hire only those with above average overall safety scores would have resulted in a significant drop in major accidents. Furthermore, these effects were more pronounced as tenure increased.

7.2 Case Study #2

Case Study #2 contained data from 789 employees in a national postal and parcel delivery organization. These employees occupied several different jobs, primarily associated with receiving, transporting, and delivering packages. Data were available for customer service jobs as well as those including a component of physical labor, such as heavy lifting and machinery operation. Employees completed the HPI either prior to or during their employment. We used employees' HPI data to calculate safety scores. This allowed us to classify employees into above and below average safety score groups.

The criterion variable was citations for "unsafe work behaviors" resulting in accidents or injuries. In the sample, 91 individuals (12%) had violations for unsafe work behaviors.

Analyses revealed several important results. For example,

- Employees who tend to be easily sidetracked (low Vigilant) and hard to train (low Trainable) were more likely to have citations for "unsafe work behaviors" than those who tend to stay focused on the task at hand (high Vigilant) and enjoy learning (high Trainable).
- Individuals with above average overall safety scores had 25% fewer citations for "unsafe work behaviors" compared to those with below average overall safety scores.

When excluding those in customer service jobs (limiting analyses to only those
jobs in which safe work behaviors represent an important component of
successful performance), those in the above average safety score group reported
36% fewer violations in safe working behavior than those in the below average
safety score group.

By hiring only individuals with above average overall safety scores, the company could have reduced its number of citations by nearly 15%. Furthermore, although the impact of using the Safety Report is consistent across jobs, it is more consequential for jobs with a higher potential for accidents and injuries.

7.3 Case Study #3

Case Study #3 contained data from 194 bus operators in a large, west coast U.S. metropolitan transportation authority. These employees drive buses and are responsible for transporting passengers, memorizing routes and fare structures, collecting fares, issuing tickets, and providing information to passengers. Employees completed the HPI either prior to or during their employment.

Objective criteria for this study were accidents involving passengers, documented rule violations, and worker compensation claims. Base rates for individuals with accidents, rule violations, and worker compensation claims were 11%, 69%, and 77%, respectively. Using overall safety scores derived from HPI data, we classified drivers into above average and below average safety score groups.

Analyses revealed several important results. For example,

- Bus operators who tend to become easily angered (low Emotionally Stable) were more likely to have accidents and file worker compensation claims compared to those who tend to control their tempers (high Emotionally Stable).
- Those employees who tend to not follow company rules (low Compliant), become
 easily distracted (low Vigilant), and take careless risks (low Cautious) were more
 likely to have documented rule violations than bus operators who appear ruleabiding (high Compliant), focused (high Vigilant), and tend to weigh the
 consequences before taking risks (high Cautious).
- Bus operators with above average overall safety scores had 31% fewer accidents and 20% fewer rule violations compared to those with below average overall safety scores.

These results indicate that individuals in the below average safety score group accounted for more accidents, rule violations, and worker compensation claims than those in the above average safety score group. This demonstrates the value of the Safety Report for identifying individuals likely to experience fewer unsafe work behaviors across multiple work-related outcomes.

7.4 Case Study #4

Case Study #4 contained data from 37 assembly workers in a small midwestern manufacturing company. These employees assembled small appliances. Tasks involved inserting and tightening screws and bolts, aligning appliance components, connecting electrical wires, and inspecting final products for proper use and potential malfunctions. Tenure for all individuals was at least 1 year. The criterion consisted of worker compensation claims filed over the past 2 years.

Initially, the company provided Hogan with data for 17 individuals who had filed worker compensation claims. To provide a comparison group, the organization identified 20 employees who had not filed such claims. Individuals in both groups completed the HPI either prior to or during their employment. Based on HPI scores, we calculated safety scores and compared those in the below average safety score group to those falling in the above average safety score category. Table 7.1 presents the results of these analyses.

Table 7.1
Results for Case Study #4

Predictor Outcome -	Safety Outcome					
- Fredictor Outcome	Claim	No Claim	% with Claim			
Below Average Safety Score Group	12	7	63%			
Above Average Safety Score Group	5	13	28%			

As seen in Table 7.1, 63% of individuals in the below average safety score group filed a worker compensation claim, compared to only 28% of those falling in the above average safety score category. In addition, Hogan found that employees who tend to be easily distracted (low Vigilant) and take unnecessary risks (low Cautious) were more likely to have filed worker compensation claims over a 2-year period compared to employees who tend to be focused (high Vigilant) and evaluate risks (high Cautious). These results demonstrate that, for this organization, using the Safety Report to hire only those in the above average safety score group would have resulted in a 40% decrease in worker compensation claims.

42 —

7.5 Case Study #5

Case Study #5 contained data from 64 truck drivers in a U.S.-based national freight transportation company. These drivers transported freight to clients, recorded quantities loaded and delivered, and read various gauges and meters.

The criterion was on-the-job injuries. Eleven drivers had recorded injuries (17%). Employees completed the HPI either prior to or during their employment. Based on HPI scores, we calculated safety scores and compared those in the below average safety score group to those falling in the above average safety score group. Table 7.2 presents these results.

Table 7.2 Results for Case Study #5

Predictor Outcome —		Safety Outcome	_
Fredictor Outcome =	Injury	No Injury	% with Injury
Below Average Safety Score Group	8	20	29%
Above Average Safety Score Group	3	33	8%

As seen in Table 7.2, 29% of individuals in the below average safety score group had a recorded on-the-job injury, compared to only 8% of those in the above average safety score group. Drivers with below average overall safety scores were over 4 times more likely to have injuries on the job compared to those with above average overall safety scores. Also, results revealed that drivers who tend to ignore authority and company policies (low Compliant) and lose their tempers (low Emotionally Stable) were more likely to have injuries compared to drivers who tend to follow company rules (high Compliant) and control their emotions (high Emotionally Stable). These results indicate that, for this organization, using the Safety Report to hire only those in the above average safety score group would have resulted in a 52% injury reduction.

7.6 Case Study #6

Case Study #6 contained data from 37 truck drivers in another U.S.-based national freight transportation company. These drivers transported and delivered shipments across the country. The criterion variable was traffic citations.

The company identified 26 drivers who had traffic citations. Also, to provide a comparison group, the organization identified 11 drivers who had not received citations. Individuals completed the HPI either prior to or during their employment. Based on HPI scores, we calculated safety scores and compared those with below average overall safety scores to individuals with above average overall safety scores. Table 7.3 presents the results of these analyses.

Table 7.3
Results for Case Study #6

Predictor Outcome	Safety Outcome					
Fredictor Outcome	Citation	No Citation	% with Citation			
Below Average Safety Score Group	14	5	74%			
Above Average Safety Score Group	12	6	67%			

As seen in Table 7.3, 74% of drivers in the below average safety score group received traffic citations, compared to 67% of those in the above average safety score category. In addition, Hogan found that drivers who tend to be more alert and attentive (high Vigilant) and listen to feedback (high Trainable) were less likely to have a citation compared to those who tend to be sidetracked (low Vigilant) and overestimate their ability (low Trainable). Because of the unusually high base rate of reported citations in this sample, it is likely that a greater reduction in citations would be observed if a more adequate comparison group (i.e., more individuals with no citations) were available for analyses.

7.7 Case Study #7

Case study #7 involved safety ratings from 129 employees and accident data on over 2,000 employees in a large consumer foods manufacturing company. These individuals occupied entry-level manufacturing jobs in the production and packaging departments. Jobs included components of physical labor, such as heavy lifting and manipulation of machinery.

Hogan calculated safety scores and compared those with above average overall safety scores to those with below average overall safety scores. Hogan collected supervisor safety ratings and obtained objective safety data, which included all accidents occurring over a 3-year period. Base rate analyses revealed that 5% of the sample reported at least one accident whereas only 2% of the sample reported two or more accidents.

Analyses revealed several results. For example,

- Individuals with higher than average overall safety scores were rated as less likely to engage in unsafe behaviors, and more likely to both follow rules and promote safety among coworkers.
- Employees who tend to make mistakes because they panic (low Strong) and lose their tempers (low Emotionally Stable) were more likely to have accidents than those who tend to remain calm and steady (high Strong) and control their anger (high Emotionally Stable).
- In addition, as compared to those with below average overall safety scores, employees with above average overall safety scores were 10% less likely to have one or more accidents over a 3-year period and 36% less likely to have two or more accidents over this time.

7.8 Summary of Case Study Results

We examined the results of the seven case studies to evaluate the effectiveness of the Safety Report for identifying individuals likely to engage in safe versus unsafe work behaviors. These results are consistent across a number of safety-related objective variables (e.g., accidents, injuries, worker compensation claims, and traffic citations) and across jobs and organizations. In all seven samples, the use of the Safety Report to select employees could have reduced incident rates by approximately 15% to 50%. Considering the costs associated with safety-related incidents, these outcomes represent a significant Return on Investment (ROI) for organizations with jobs in which safety-related work outcomes are critical to successful performance.

8. APPLICATIONS AND RECOMMENDATIONS

The Hogan archive provided the source data to develop the Safety Report scales. Hogan used HIC-level data from the HPI and job performance criteria to develop scoring algorithms for safety and general employability competencies. These results specified facets of personality related to competency-based performance criteria.

8.1 Scoring

For each scale included in the Safety Report, we computed final scale scores by converting results from each algorithm to a 0 to 100 scale. Table 8.1 presents means and standard deviations for each scale from the international normative sample (N = 5,785; Hogan Assessment Systems, 2009b).

Table 8.1
Scale Means and Standard Deviations

Scale	М	SD
Compliant	54.68	13.57
Strong	80.27	14.25
Emotionally Stable	71.74	14.08
Vigilant	42.00	14.67
Cautious	39.60	15.05
Trainable	67.83	10.46
Dependability	41.76	14.53
Composure	80.98	15.91
Customer Focus	80.05	12.84

Note. N = 5,785. M = Mean; SD = Standard deviation.

As seen in Table 8.1, means and standard deviations varied across scales, indicating that score distributions varied. For this reason, we used normative results to convert scores on each dimension of the competency model to a common metric. The Safety Report presents these results on continuous scales with low scores indicating *High Concern* (bottom 5%) and high scores indicating *Low Concern* (top 5%) for each safety scale. We used the same percentages to indicate *Developmental Needs* (bottom 5%) and *Strengths* (top 5%) for the general employability scales. Appendix C provides a sample Safety Report.

46

8.2 Simulated Adverse Impact

Hogan evaluated potential selection rates for gender, age, and race/ethnicity. Relevant racial/ethnic groups vary by country. For the analyses presented below, we evaluated pass rates from a sample of 104,998 entry-level job applicants in the U.S. who reported race/ethnicity according to EEOC guidelines. Safety Report users should evaluate pass rate differences based on race/ethnicity in other countries as data are available.

For these analyses, which serve only as estimates of potential selection rates in lieu of actual applicant data for specific organizations, we compared individuals with scores in the bottom 25% to those in the top 75%. A number of non-test factors, most notably the opportunity to take the assessment, affect selection rates. Tables 8.2 through 8.7 show the selection rates for each safety scale based on data from a HPI archival sample by demographic group, where males, whites, and applicants under 40 years of age serve as majority groups. Based on the 80% rule-of-thumb (or the *four-fifths rule*) described in the EEOC's *Uniform Guidelines* (1978), these findings suggest that the inclusion of the safety competency model as a potential selection device should not result in adverse impact.

Table 8.2
Compliant Safety Scale Adverse Impact Results

		Fail	%	Pass	%	A.I. ratio
Total		25,775	24.55%	79,223	75.45%	
Sex	Men	12,063	32.06%	25,562	67.94%	
	Women	9,138	18.85%	39,334	81.15%	No A.I.
Age	< 40	8,884	29.64%	21,084	70.36%	
	<u>></u> 40	1,675	20.24%	6,599	79.76%	No A.I.
Race	Black/African American	1,573	17.89%	7,220	82.11%	No A.I.
	Hispanic/Latino	2,352	18.81%	10,154	81.19%	No A.I.
	Asian American/P.I.	1,146	27.29%	3,054	72.71%	No A.I.
	American Indian/A.N.	472	24.41%	1,462	75.59%	No A.I.
	White	14,138	26.43%	39,349	73.57%	

Table 8.3 Strong Safety Scale Adverse Impact Results

		Fail	%	Pass	%	A.I. ratio
Total		45,438	43.28%	59,560	56.72%	
Sex	Men	18,351	48.77%	19,274	51.23%	
	Women	18,818	38.82%	29,654	61.18%	No A.I.
Age	< 40	14,590	48.69%	15,378	51.31%	
	<u>></u> 40	3,468	41.91%	4,806	58.09%	No A.I.
Race	Black/African American	3,130	35.60%	5,663	64.40%	No A.I.
	Hispanic/Latino	4,398	35.17%	8,108	64.83%	No A.I.
	Asian American/P.I.	2,156	51.33%	2,044	48.67%	No A.I.
	American Indian/A.N.	849	43.90%	1,085	56.10%	No A.I.
	White	24,027	44.92%	29,460	55.08%	

Table 8.4 Emotionally Stable Safety Scale Adverse Impact Results

		Fail	%	Pass	%	A.I. ratio
Total		25,859	24.63%	79,139	75.37%	
Sex	Men	10,669	28.36%	26,956	71.64%	
	Women	10,428	21.51%	38,044	78.49%	No A.I.
Age	< 40	8,574	28.61%	21,394	75.62%	
	<u>></u> 40	2,017	24.38%	6,257	77.13%	No A.I.
Race	Black/African American	1,659	18.87%	7,134	81.13%	No A.I.
	Hispanic/Latino	2,249	19.98%	10,257	82.02%	No A.I.
	Asian American/P.I.	1,279	30.45%	2,921	69.55%	No A.I.
	American Indian/A.N.	478	24.72%	1,456	75.28%	No A.I.
	White	13,877	25.94%	39,610	74.06%	

Table 8.5 Vigilant Safety Scale Adverse Impact Results

		Fail	%	Pass	%	A.I. ratio
Total		26,273	25.02%	78,725	74.98%	
Sex	Men	11,275	29.97%	26,350	70.03%	
	Women	10,901	22.49%	37,571	77.51%	No A.I.
Age	< 40	8,330	27.80%	21,638	72.20%	
	<u>≥</u> 40	1,194	14.43%	7,080	85.57%	No A.I.
Race	Black/African American	1,631	18.55%	7,162	81.45%	No A.I.
	Hispanic/Latino	2,860	22.57%	9,646	77.13%	No A.I.
	Asian American/P.I.	1,135	27.02%	3,065	72.98%	No A.I.
	American Indian/A.N.	508	26.27%	1,426	73.73%	No A.I.
	White	14,757	27.59%	38,730	72.41%	

Table 8.6
Cautious Safety Scale Adverse Impact Results

		Fail	%	Pass	%	A.I. ratio
Total		26,508	25.25%	78,490	74.75%	
Sex	Men	11,133	29.59%	26,492	70.41%	
	Women	11,229	23.17%	37,243	76.83%	No A.I.
Age	< 40	8,460	28.23%	21,508	71.77%	
	<u>></u> 40	1,323	15.99%	6,951	84.01%	No A.I.
Race	Black/African American	1,687	19.19%	7,106	80.81%	No A.I.
	Hispanic/Latino	2,673	21.37%	9,833	78.63%	No A.I.
	Asian American/P.I.	1,043	24.83%	3,157	75.17%	No A.I.
	American Indian/A.N.	483	24.97%	1,451	75.03%	No A.I.
	White	15,058	28.15%	38,429	71.85%	

Table 8.7
Trainable Safety Scale Adverse Impact Results

		Fail	%	Pass	%	A.I. ratio
Total		26,227	24.98%	78,771	75.02%	
Sex	Men	10,318	27.42%	27,307	72.58%	
	Women	10,815	22.31%	37,657	77.69%	No A.I.
Age	< 40	8,126	27.12%	21,842	72.88%	
	<u>></u> 40	2,506	30.29%	5,768	69.71%	No A.I.
Race	Black/African American	1,431	16.27%	7,362	83.73%	No A.I.
	Hispanic/Latino	2,254	18.02%	10,252	81.98%	No A.I.
	Asian American/P.I.	876	20.86%	3,324	79.14%	No A.I.
	American Indian/A.N.	393	20.32%	1,541	79.68%	No A.I.
	White	14,634	27.36%	38,853	72.64%	

Also, Hogan evaluated the potential selection rates for gender, age, and race/ethnicity on the general employability scales. Again, we compared individuals with scores in the bottom 25% to those in the top 75%. Tables 8.8 through 8.10 present these results.

Table 8.8

Dependability Advantage Scale Adverse Impact Results

		Fail	%	Pass	%	A.I. ratio
Total		23,792	22.66%	81,206	77.34%	
Sex	Men	11,052	29.37%	26,573	70.63%	
	Women	8,369	17.27%	40,103	82.73%	No A.I.
Age	< 40	7,657	25.55%	22,311	74.45%	
	<u>≥</u> 40	1,512	18.27%	6,672	81.73%	No A.I.
Race	Black/African American	1,727	19.64%	7,066	80.36%	No A.I.
	Hispanic/Latino	2,741	21.92%	9,765	78.08%	No A.I.
	Asian American/P.I.	1,190	28.33%	3,010	71.67%	No A.I.
	American Indian/A.N.	504	26.06%	1,430	73.94%	No A.I.
	White	11,911	22.27%	41,576	77.73%	

Table 8.9 Composure Advantage Scale Adverse Impact Results

		Fail	%	Pass	%	A.I. ratio
Total		25,723	24.50%	79,275	75.50%	
Sex	Men	9,127	24.26%	28,498	75.74%	
	Women	11,671	24.08%	36,801	75.92%	No A.I.
Age	< 40	8,146	27.18%	21,822	72.82%	
	<u>></u> 40	2,156	26.06%	6,118	73.94%	No A.I.
Race	Black/African American	1,813	20.62%	6,980	79.38%	No A.I.
	Hispanic/Latino	2,545	20.35%	9,961	79.65%	No A.I.
	Asian American/P.I.	1,216	28.95%	2,984	71.05%	No A.I.
	American Indian/A.N.	491	25.39%	1,443	74.61%	No A.I.
	White	13,159	24.60%	40,328	75.40%	

Table 8.10
Customer Focus Advantage Scale Adverse Impact Results

		Fail	%	Pass	%	A.I. ratio
Total		26,742	25.47%	78,256	74.53%	
Sex	Men	10,338	27.48%	27,287	72.52%	
	Women	11,138	22.98%	37,334	77.02%	No A.I.
Age	< 40	7,791	26.00%	22,177	74.00%	
	<u>></u> 40	2,345	28.34%	5,929	71.66%	No A.I.
Race	Black/African American	2,232	25.38%	6,561	74.62%	No A.I.
	Hispanic/Latino	3,186	25.48%	9,320	74.52%	No A.I.
	Asian American/P.I.	1,513	36.02%	2,687	63.98%	No A.I.
	American Indian/A.N.	551	28.49%	1,383	71.51%	No A.I.
	White	12,416	23.21%	41,071	76.79%	

Note. P.I. = Pacific Islander; A.N. = Alaskan Native; A.I. = Adverse impact.

The results of these analyses further confirm that the inclusion of the safety-related and general employability scales as a potential selection device should not result in adverse impact.

8.3 Uses and Applications

Hogan recommends the use of the Safety Report to assess the personal characteristics and individual differences of job applicants and incumbent employees that relate to safe work behavior and general employability. By administering the HPI and using assessment scores to predict safety competency behaviors and those relating to general employability, employers should be able to maximize the utility of their selection procedures for hiring safer and more effective employees.

There are two uses for the Safety Report: (a) to help companies make better informed hiring decisions concerning applicants for safety-sensitive jobs, and (b) to help companies gauge the extent to which their incumbent workforce is comprised of safe and high performing workers. This second use may inform training needs and initiatives, but it should not be used to inform personnel decisions (e.g., termination) involving current incumbents. For personnel selection, it is critical that the company use the Safety Report for every applicant within a hiring cycle to ensure standardization and fairness in the selection process.

The Safety Report consists of scales developed from the HPI using competency-based scoring algorithms. Users of the Safety Report should expect the same psychometric qualities as the HPI—validity and reliability—that will assist in building a safe and productive workforce. The *HPI Manual* (R. Hogan & J. Hogan, 2007) describes the psychometric properties of the HPI.

The following procedures will help employers use and monitor the Safety Report. First, pass rates require monitoring to determine if the recommended scoring algorithms allow enough people to pass at high levels and accurately identify individuals who are prone to unsafe or ineffective work behaviors. Algorithms where everyone fails are just as ineffective as those where everyone passes. Second, employers should maintain records of scores by demographic group to monitor the possibility of adverse impact resulting from the use of these competency-based algorithms. Finally, Hogan recommends conducting follow-up analyses on applicants and employees assessed using the Safety Report to examine the utility and bottom-line impact of the assessment.

For further information concerning this research or the results provided in this manual, please contact:

Hogan Assessment Systems P.O. Box 521176 Tulsa, Oklahoma 74152 (918) 749-0632

8.4 Accuracy and Completeness

Hogan attests to the accuracy of the data collection, analysis, and reporting procedures used in these studies. Hogan entered the data into a database and computed results using SPSS/V.12.0 statistical software.

To develop competency-based scoring algorithms, Hogan reviewed an archival research database with previously conducted criterion-related validation studies, and identified studies using job performance measures mapping to safety-related and general employability competencies. We used these data to develop scoring algorithms through both a qualitative, theoretical approach and a quantitative, empirical approach. Then, we tested alternative algorithms to maximize predictive validity and minimize scale overlap. Hogan derived results strictly from data and archived study results and did not embellish, falsify, or alter results in any manner.

9. COMPILATION OF NORMS

9.1 Importance of Norms for Interpretation and Decision-Making

Raw assessment scores provide little information without appropriate norms to provide context for their interpretation. According to Nunnally (1967, p. 244), "norms are any scores that provide a frame of reference for interpreting the scores of particular persons." As such, norms are vital for providing meaningful context for interpreting assessment scores. However, the quality of those norms is of particular importance. By using accurate and up-to-date norms, users can examine one person's scores against a suitable comparison group and, relative to those others, predict that person's future behavior.

9.1.1 Presentation of Normative Data

Assessment providers use a variety of formats to present normative data. However, three formats are most prevalent: (a) raw scale scores, (b) standardized scores, and (c) percentile ranks (Nunnally, 1967). Although raw scale scores directly link to the assessment, they are difficult to interpret because total possible scores may vary. For example, a raw scale score of "8" is difficult to interpret because the total possible score could be 10, 50, 100, 1000, or any other score. Depending on the total possible score, one would interpret a raw scale score of "8" in vastly different lights.

To address these problems, some assessment publishers provide norms in the form of standardized scores. Standardized scores are expressed using a mean and a standard deviation, although these vary depending on the type of standardized score used. For example, *z*-scores use a mean of 0 and standard deviation of 1. Alternatively, *T*-scores use a mean of 50 and standard deviation of 10. *Sten scores* use a mean of 5.5 and standard deviation of 2. As these examples illustrate, standardized scores transform an individual's raw scale score into a ranking metric, but these score ranges vary and, like raw scores, are not easily understood.

Unlike the two methods previously described, the *HPI Manual* (R. Hogan & J. Hogan, 2007) specifies that the HPI be interpreted using percentile ranks. Percentile ranks represent an alternative to standardized scores. Like standardized scores, percentiles place an individual's raw scale score on a ranking metric where users can compare one person's scores against others' scores. However, unlike standardized scores with ranges of -3 to +3 (z-scores), 20 to 80 (T-scores), or 1 to 10 (Sten scores), percentile ranks use a 0 to 100 range, most commonly understood and easily interpreted by the general public. For example, a raw Adjustment scale score may correspond to a z-score of 1.1. However, it is difficult to interpret this

54

standardized score. That same scale score may correspond to a percentile score of 85%, facilitating the easy interpretation that this person scores above 85% of others on that scale. As we used HIC-level data from the HPI to develop scoring algorithms for the Safety Report, we remain consistent with HPI norms, presenting the Safety Report norms as percentile ranks.

9.1.2 Professional Standards for Norm Development

Cronbach (1984) noted that the norms for many personality assessments are notoriously inadequate and emphasized the importance of using appropriate samples when calculating norms. To provide norms, assessment providers collect data from suitable and representative individuals in the assessment's intended population(s). Specifically, Cronbach provided four standards for developing adequate norms, stating that they should (a) consist of individuals for whom the assessment was intended and against whom examinees will be compared, (b) represent the referent population, (c) include a sufficient number of cases, and (d) be appropriately subdivided. Also, practical and professional considerations encourage assessment providers to establish and maintain norms. For example, Standard 4.6 of the *Standards* (AERA, APA, & NCME, 1999) states:

Reports of norming studies should include precise specification of the population that was sampled, sampling procedures and participation rates, any weighting of the sample, the dates of testing, and descriptive statistics. The information provided should be sufficient to enable users to judge the appropriateness of the norms for interpreting the scores of local examinees. Technical documentation should indicate the precision of the norms themselves. (p. 55)

Hogan presents normative data for the Safety Report using a sample that is representative of the intended use of the assessment. As we developed the Safety Report for global use, the normative dataset represents multiple languages, cultures, and geographic regions. The primary concern with multi-language norms is the appropriateness of combining data derived from multiple translations. Schmitt, Allik, McCrae, and Benet-Martinez (2007) summarize this issue, stating:

...when comparing the mean scores of different cultures on a personality trait scale, any observed differences may exist not only because of a real cultural disparity on some personality trait but also because of inappropriate translations, biased sampling, or the non-identical response styles of people from different cultures. (p. 175)

Meyer and Foster (2008) outline three potential sources of mean score differences: (a) sample differences, (b) translation differences, and (c) cultural differences. Hogan accounts for potential sample and translation differences by (a) following rigorous guidelines when creating new translations and (b) testing both item- and scale-level equivalence when enough data are available for a language. *The Development and Technical Review of Translations for the HPI, HDS, and MVPI* (Hogan Assessment Systems, 2009a) outlines our procedures for developing and reviewing translations and presents results for all translations conducted to date. These results show that current translations of the HPI produce similar distributions. Although no two translations are perfectly equivalent, such similarity across translations (a) demonstrates that cultural differences have little impact on score distributions and (b) supports the use of combining data from multiple languages into a single normative dataset.

Where sufficient data were available, we divided these norms by demographic variables of interest. Using percentile ranks, these normative data are easily interpretable, facilitating decision-making in applied personnel contexts. These considerations ensure that norms provided for the Safety Report adhere to existing professional guidelines and standards.

9.2 Norm Composition

Hogan developed the Safety Report primarily as a selection assessment for identifying individuals who have characteristics associated with success in entry-level jobs that have a strong safety component. To develop a comprehensive sampling strategy for creating norms for the Safety Report, we first identified stratification variables. These variables served as criteria to ensure that the norms achieve proportionate representation of respondents across intended jobs. Specifically, we identified (a) job families and (b) languages as key stratification variables that guided the development of the Safety Report norms. Although not used for stratification purposes, we examined normative data by age and gender. We did not examine normative data by race/ethnicity because of the inconsistency in racial/ethnic coding across countries.

9.2.1 Stratified Sampling of the Norming Population

We included data collected on-line between June 10, 2003 and February 19, 2009. We included cases from multiple entry-level jobs across job families. Using as many cases from each available language as possible, we ensured that we could eliminate cases as needed to balance across both job families and languages. This effort to maximize representation across job families and languages resulted in an initial sample of 12,878 cases.

Then, we limited the number of cases for each job family, within language, to ensure that no one job family or specific client organization was overly represented in the data. Next, we limited the number of cases per language to 500. Finally, we removed all cases with missing data. This resulted in a final sample of 5,785 cases.

9.2.2 Job Families

Job families represent clusters of occupations grouped together based on the similarity of work performed, skills, education, training, and other credentials required for successful job performance. To classify jobs into job families, Hogan used the U.S. DoL job categories. We chose this occupational system for two main reasons: (a) the classifications provided by the U.S. DoL are comprehensive enough to represent nearly any job around the world and (b) the job classifications are conceptually clear and easy to use as a stratification variable. As the target population of the Safety Report is persons in entry-level jobs, Hogan included only applicants and incumbents in entry-level jobs in the development of the normative sample. Table 9.1 presents norm composition by U.S. DoL job family.

Table 9.1

Norming Sample Distribution by U.S. DoL Job Family

U.S. DoL Job Family	Number	Percent
Computer & Mathematical Science	210	3.6%
Life, Physical, & Social Science	120	2.1%
Community & Social Services	948	16.4%
Education, Training, & Library	145	2.5%
Healthcare Practitioner & Technical	223	3.9%
Protective Service	184	3.2%
Food Preparation & Serving Related	191	3.3%
Personal Care & Services	230	4.0%
Sales & Related	1,139	19.7%
Office and Administrative	912	15.8%
Construction & Extraction	169	2.9%
Installation, Maintenance, & Repair	124	2.1%
Production	485	8.4%
Transportation & Material Moving	409	7.1%
Other	296	5.1%
TOTAL	5,785	100.0%

9.2.3 Language

Because we have developed multiple translations for the HPI, we included data from multiple languages when developing the normative dataset. Specifically, we included data from a language if HPI scores were available representing entry-level jobs. The dataset is comprised of data from applicants and incumbents assessed in over 20 languages. We limited the initial dataset to 500 cases per language. When more than 500 cases of data were available for a language, we randomly selected from a pool of relevant applicants and incumbents. When fewer than 500 cases were available for a language, we included all possible cases. Although less than 10 cases were available for six languages, more than 500 cases were available for eight languages, thereby ensuring that no one language was over represented. Then, we removed cases with missing data. Table 9.2 presents norm composition by language.

58

Table 9.2

Norming Sample Distribution by Language

Language	Number	Percent
Brazilian Portuguese	43	.7%
Castilian Spanish	18	.3%
Czech	497	8.6%
Danish	280	4.8%
British English	444	7.7%
American English	499	8.6%
Spanish	493	8.5%
French (Canadian)	121	2.1%
French (Parisian)	154	2.7%
German	199	3.4%
Icelandic	34	.6%
Italian	11	.2%
Kenyan English	487	8.4%
Dutch	18	.3%
Norwegian	492	8.5%
New Zealand English	495	8.6%
Polish	25	.4%
Russian	113	2.0%
Slovak	94	1.6%
Swedish	494	8.5%
Thai	114	2.0%
Turkish	499	8.6%
Other	160	2.8%
TOTAL	5,785	100.0%

9.2.4 Gender and Age

Although not all respondents reported gender and age data, a sufficient number of respondents reported both demographic variables for us to examine representation across these groups. From the normative dataset, 4,705 (81.3%) individuals reported gender and 4,646 (80.3%) reported age. Consistent with the U.S. Age Discrimination in Employment Act of 1967 (Lindemann, Grossman, & Cane, 1996), we examined pass rates for respondents who were under 40 years of age when they completed the assessment against respondents 40 years of age or older. Table 9.3 presents norm composition by both gender and age.

Table 9.3

Norming Sample Distribution by Gender and Age

	Number	Percent
Gender		
Males	2,608	55.4%
Females	2,097	44.6%
TOTAL	4,705	100.0%
Age		
Under 40	3,586	77.2%
40 and older	1,060	22.8%
TOTAL	4,646	100.0%

Tables 9.1 through 9.3 demonstrate that this final normative sample represents all job families, languages, and age and gender groups under consideration. Based on these factors, we conclude that the Safety Report norms cover entry-level jobs across a broad cross-section of job families, languages, and demographic variables.

9.3 Descriptive Statistics of the Norming Sample

Table 9.4 presents means and standard deviations for the safety scales for the total normative sample categorized by selected demographic groups. Appendix D presents raw score to percentile conversions for the total sample (see Table D1).

Table 9.4
Norming Sample Scale Means and Standard Deviations

Competency		Males	Females	Under 40	40 and Older	TOTAL
N		2,608	2,097	3,586	1,060	5,785
Compliant	М	52.43	56.53	53.72	57.25	54.68
	SD	13.53	13.03	13.26	13.91	13.57
Strong	М	81.27	77.39	79.78	80.98	80.27
	SD	13.88	14.75	14.04	14.75	14.25
Emotionally Stable	Μ	69.93	72.71	71.13	72.87	71.74
	SD	13.91	14.28	14.22	13.41	14.08
Vigilant	Μ	41.53	43.42	40.75	47.04	42.00
	SD	14.52	14.46	14.17	14.83	14.68
Cautious	М	39.74	40.12	38.82	43.00	39.60
	SD	14.92	14.65	14.53	15.77	15.05

60

Table 9.4 cont.

Norming Sample Scale Means and Standard Deviations

Competency		Males	Females	Under 40	40 and Older	TOTAL
N		2,608	2,097	3,586	1,060	5,785
Trainable	M	66.83	68.24	67.94	67.22	67.83
	SD	10.24	10.67	10.55	10.09	10.46
Dependability	M	39.02	44.56	41.30	43.64	41.76
	SD	13.92	14.43	14.35	14.54	14.53
Composure	M	80.11	80.39	80.03	82.97	80.98
	SD	16.41	16.17	16.08	15.81	15.91
Customer Focus	M	78.52	80.56	79.85	80.48	80.05
	SD	13.08	12.29	12.52	12.99	12.84

Note. N = Number of cases; M = Mean; SD = Standard deviation.

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APPENDIX A: Comparison between Standard HPI and Safety Report HIC Names

Table A1
Comparison between Standard HPI and Safety Report HIC Names

Standard HPI Scale and HIC	Safety Report HIC
Adjustment	
Not Anxious	Composed
No Guilt	Self-Accepting/Self-Assured*
Calmness	Calm
Good Attachment	Respect for Authority
Ambition	
Self Confident	Confident
No Social Anxiety	Bold (R)
Sociability	
Likes Parties	Disciplined (R)
Likes Crowds	Focused (R)
Experience Seeking	Adventurous (R)
Exhibitionistic	Attention Seeking (R)
Entertaining	Outgoing (R)
Interpersonal Sensitivity	
No Hostility	Agreeable
Prudence	
Moralistic	Rule-Following
Mastery	Diligent
Not Spontaneous	Organized
Impulse Control	Self-Control
Avoids Trouble	Conforming
Inquisitive	
Curiosity	Curiosity (R)
Intellectual Games	Analytical
Generates Ideas	Creative (R)
Culture	Openness
Learning Approach	
Good Memory	Memory

Note. *We assigned the No Guilt HIC two different names across two safety scales to facilitate the presentation of developmental feedback. Only HICs used in the Safety Report are listed; R = Reverse scored.

APPENDIX B: The Competency Evaluation Tool (CET)

INST	DI	ICI	ΠO	NIQ.

Below is a list of competencies associated with successful job performance across many jobs. Please rate the extent to which each competency IMPROVES job performance in the ______ job. Please evaluate every competency. Try to work quickly. Do not spend too much time thinking about any single competency.

	Not Associated with Job Performance	Minimally Concerned with Job Performance	Helpful for Job Performance	Important for Job Performance	<u>Critical</u> for Job Performance
_	0	1	2	3	4
1.	<u>Competency</u> Stress Tolerance	<u>Definition</u> Handles pressure witho	ut getting upset, moody, o	anxious	<u>Rating</u> ① ① ② ③ ④
2.	Work Attitude	Has a positive attitude t	toward work		
3.	Achievement Orientation	Strives to meet and exc	eed goals for self and othe	rs	
4.	Initiative	Takes action before bei	ng told what to do		
5.	Leadership	Provides direction and r	motivates others to work fo	r a common goal	0 1 2 3 4
6.	Customer Service	Provides courteous and	helpful service to custome	ers and associates	
7.	Interpersonal Skills	Gets along well with oth situations	ers, is tactful, and behave	s appropriately in social	0 0 2 3 4
8.	Teamwork		d is a good team player		0 0 2 3 4
9.	Integrity	Follows rules and is a g	ood organizational citizen		000034
10.	Trustworthiness	Is honest and trustwort	hy		000000
11.	Detail Orientation	Performs work with grea	at care and accuracy over a	a period of time	000000
12.	Safety	Follows safety precaution	ons and displays safe on-th	e-job behavior	000000
13.	Planning/Organizing	Plans work to maximize downtime	efficiency (in time and res	ources) and minimize	0 0 2 3 4
14.	Dependability		sistent and timely manner		0 0 2 3 4
15.	Decision Making	Evaluates issues and us	ses sound reasoning to ma	ke decisions	
16.	Problem Solving	Identifies and implemen	nts effective solutions to pr	oblems	000000
17.	Teaching Others	Provides training for oth	ners		
18.	Math Skills	Uses mathematics appr	opriately to answer questi	ons or solve problems	000034
19.	Job Knowledge	Understands all aspects	s of the job		
20.	Training Performance	Performs well in job trai	ning sessions or courses		
21.	Conflict Resolution	Resolves interpersonal	problems and disputes wit	h tact and decisiveness	
22.	Organizational Commitment	Shows dedication and le	oyalty to his/her company		<u> </u>
23.	Citizenship	Represents the compar	y favorably to outsiders _		
24.	Flexibility	Adapts quickly to chang methods outsiders	ing circumstances and is v	villing to try new	0 1 2 3 4
25.	Management Performance	Coordinates resources	to maximize productivity ar	nd efficiency	0 1 2 3 4

THE DEVELOPMENT AND VALIDATION OF SAFETY COMPETENCY SCALES

26.	Industry Knowledge	Understands the industry and its emerging trends	0 1 2 3 4
27.	Influence	Provides effective rationale to support own opinion and ideas	0 1 2 3 4
28.	Employee Development	Provides support and career direction to peers and subordinates	0 1 2 3 4
29.	Strategic Vision	Understands and talks about the big picture	0 1 2 3 4
	Judgment	Uses and synthesizes information to solve problems, make evaluations, and draw sound conclusions based on subjective and/or objective criteria	0 1 2 3 4
31.	Oral Communication	Conveys information clearly and expresses self well in conversations	0 1 2 3 4
32.	Written Communication	Writes clearly and concisely	0 1 2 3 4
33.	Technical Knowledge	Uses existing technology and considers the use of new technology to increase productivity	0 1 2 3 4
34.	Adaptability	Is able to change directions quickly and work without explicit guidance	0 1 2 3 4
35.	Delegation	Assigns work to others based on their skills and future development needs	0 1 2 3 4
36.	Negotiation	Explores alternatives to reach outcomes acceptable to all parties	0 1 2 3 4
37.	Impact	Creates a good first impression and commands attention and respect	0 1 2 3 4
38.	Information Monitoring	Sets up procedures to collect information needed to manage activities	0 1 2 3 4
39.	Building Strategic Work Relationships	Develops collaborative relationships to facilitate the accomplishment of work goals	0 0 2 3 4
40.	Innovation	Finds innovative solutions to problems at work	0 1 2 3 4
41.	Gaining Commitment	Uses appropriate methods to gain acceptance of ideas or plans	0 1 2 3 4
42.	Facilitating Change	Encourages others to find or adopt innovative solutions	0 1 2 3 4
43.	Risk Taking	Takes chances to achieve goals while considering possible negative consequences	0 0 2 3 4
44.	Verbal Direction	Listens to and follows verbal directions from others	0 1 2 3 4
45.	Data Entry	Ensures high quality data entry by balancing the needs for speed and accuracy	0 1 2 3 4
46.	Vigilance	Remains watchful and alert while performing monotonous tasks	0 1 2 3 4
47.	Consultative Sales	Develops understanding of client history and goals in order to offer needed services	0 1 2 3 4
48.	Facilitative Sales	Uses detailed product knowledge to facilitate the sale of products and services	0 1 2 3 4
49.	Building Partnerships	Builds strategic relationships to help achieve business goals	0 1 2 3 4
50.	Building Teams	Uses appropriate methods to build a cohesive team	0 1 2 3 4
51.	Formal Presentation	Presents ideas effectively to individuals or groups	0 1 2 3 4
52.	Sales Ability	Uses appropriate interpersonal styles and communication methods to sell products or services	0 1 2 3 4
53.	Continuous Learning	Actively identifies new areas for personal learning	0 1 2 3 4
54.	Follow-Up	Monitors the results of work assigned to others	0 1 2 3 4
55.	Meeting Participation	Is an active participant during meetings	0 1 2 3 4
56.	Meeting Leadership	Ensures that meetings accomplish their business objectives	0 1 2 3 4

76 _____

APPENDIX C: Sample Safety Report





INTRODUCTION

Each year accidents at work cause unnecessary human misery and billions of dollars in needless business expenses. Accidents are caused by unsafe work behavior, which is often unintentional—unsafe work behavior frequently results from a simple lack of awareness. This Safety Report will help improve workers' safety awareness and safety behavior on the job.

People engage in unsafe behavior at work for many reasons. The more they persist in this behavior, the more likely on-the-job accidents become. Hogan has studied safe (and unsafe) work behavior since the early 1970s. Research shows that unsafe work behavior falls into six relatively distinct categories; research also shows that the behavior in all six of these categories can be predicted.

We cannot predict the occurrence of specific accidents because, from a statistical perspective, serious accidents are relatively rare. We can only predict the possibility that people will engage in certain behaviors which, if they persist, will make accidents likely.

Some people with average or high scores on this Safety Report will have had accidents—because bad things sometimes happen to good people. Similarly, many people with low or unsafe scores on this Safety Report will be accident free; nonetheless, they will be at risk for unsafe behavior that could lead to accidents—and the lower their scores, the greater the risk.

It is important to note that people in sales and management will tend to receive lower scores on this Safety Report because success in their jobs requires disciplined risk taking, bending the rules, and multi-tasking—all of which produce lower scores on most of the safety scales.

In short, the scores on this report do not predict a person's accident or safety record; rather, they suggest where a person needs to focus attention in order to be or to remain safe.



The report is organized in four sections as follows:

Section I: The first section defines the six components of safety-related behavior

and then provides a graphic summary of the candidate's assessment

results across those six components.

Section II: The second section is an optional reporting feature that can be selected

by the user. It provides an overall safety score for the candidate, based on $% \left\{ 1,2,\ldots ,n\right\}$

the graphic summary from Section I.

Section III: The third section is an optional reporting feature that can be selected by

the user. It provides information regarding development areas for persons with moderate to critical scores on the safety-related components and

access to Hogan's SafeSystem Development Webcourse.

Section IV: The fourth section is an optional reporting feature that can be selected by

the user. It concerns the candidates' overall desirability as an employee, which is defined in terms of three broad components of performance. The report then provides a graphic summary of the candidate's overall desirability. This section is often useful because a person may be a safe

worker but a bad fit for some jobs. For example, many safe workers are unable or unwilling to provide good customer service.



SECTION I - THE COMPONENTS OF SAFETY-RELATED BEHAVIOR

Defiant - Compliant: This component concerns a person's willingness to follow rules. Low scorers

may ignore rules; high scorers follow them effortlessly.

Panicky - Strong: This component concerns handling stress. Low scorers are stress prone, may

panic under pressure and make mistakes; high scorers typically remain steady.

Irritable - Cheerful: * This component concerns anger management. Low scorers may lose their

temper easily and make mistakes; high scorers control their temper.

Distractible - Vigilant: This component concerns focus. Low scorers tend to be easily distracted and

may make mistakes; high scorers remain focused.

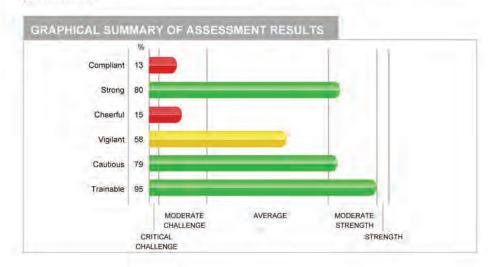
Reckless - Cautious: This component concerns risk-taking. Low scorers tend to take unnecessary

risks; high scores avoid risky actions.

Arrogant - Trainable: This component concerns trainability. Low scorers tend to ignore training and

feedback; high scorers pay attention to training.

Scores are in terms of percentiles: for example, a score of 85% means that a person's score is above 85% of people assessed.



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^{*} The safety scale labeled Cheerful in the above sample report corresponds to the safety scale labeled Emotionally Stable throughout the *Development and Validation of Safety Competency Scales* report.



SECTION I - THE COMPONENTS OF SAFETY-RELATED BEHAVIOR (Cont'd)

Safety Related Strengths

- Seems flexible about changes in rules and procedures
- Performance will not be affected by work load
- Should seem passionate and intense
- Typically aware of what is going on
- Will rarely make impulsive mistakes
- Will be interested in training opportunities

Safety Related Concerns

- · May think safety procedures are optional
- · Will rarely apologize for mistakes
- May overreact when frustrated
- May seem unimaginative
- Will be risk averse
- May be a pest about promotions

SECTION II - AVERAGE OVERALL SAFETY SCORE

The Average Overall Safety score is an average of the six safety scales presented above.



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SECTION III - DEVELOPMENTAL RECOMMENDATIONS BY SAFETY COMPONENT

The following presents the candidate's scores on the safety dimensions where a moderate or critical challenge exists. The percentages below represent the percent of items endorsed for each dimension. Dimensions with a (R) are reverse weighted so that higher percentage reflect lower scores.

SAFETY COMPONENT	DEFINITION	PERCENT ENDORSED
COMPLIANT		
Adventurous (R)	Needs Stimulation	100%
Attention Seeking (R)	Needs Attention	80%
Outgoing (R)	Needs Interaction	75%
CHEERFUL		
Attention Seeking (R)	Needs Attention	80%
Even Tempered	Seldom Upset	40%
Self-control	Avoids Impulsive Behavior	40%

The Hogan SafeSystem Development Webcourse is designed to help you more fully understand your results and create a development plan to reduce the likelihood of a safety-related incident on the job. To access this useful development tool, please visit the following website:

http://www.hoganassessments.com/development_webcourse/



SECTION IV - OVERALL EMPLOYABILITY

Although working safely is important, good employees have other attributes as well. The following characteristics are important for virtually any job.

Dependability

This scale concerns being a good organizational citizen by following rules, accepting supervision, exercising self-control, finishing assignments, and avoiding unnecessary risks. Persons with high scores tend to be consistent, reliable, and self-disciplined. Persons with low scores tend to be impulsive, distractible, and possibly non-conforming.

Composure

This scale concerns the degree to which a person seems calm, eventempered, and good humored. Persons with high scores seem to handle stress and pressure well by remaining steady, composed, and unruffled, and they tend to exert a calming influence on others. Persons with low scores tend to be tense, moody, and sensitive, and their performance may suffer when they are stressed.

Customer Focus

This scale concerns the degree to which a person can provide good customer service when it is appropriate; it is not about being charming or friendly—many introverts are good at customer service and many extraverts are bad. Persons with high scores on this measure tend to be calm, courteous, civil, and patient. Persons with low scores tend to seem inattentive, distracted, tense, and possibly abrupt.

Scores are in terms of percentile: for example, a score of 85% means that a person's score is above 85% of people assessed.



The results contained in this report are NOT meant to supersede the judgment of a hiring manager. Rather, a hiring manager should use these results as one input into his/her process for arriving at a hiring decision regarding the candidate.

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7

APPENDIX D: Norms for the Total Sample

Norms for the Total Sample

Raw	Compliant Norms	Strong Norms	Emotionally Stable Norms	Vigilant Norms	Cautious Norms	Trainable Norms	Dependability Composure Norms Norms		Customer Focus Norms
0	0	0	0	0	0	0	0	0	0
IJ	0	0	0	0	0	0	4	0	0
10	0	0	0	0	1	0	2	0	0
15	0	0	0	1	4	0	4	0	0
20	4	0	0	σı	9	0	œ	0	0
25	2	0	0	13	17	0	14	4	0
30	4	Н	1	23	29	0	25	4	0
35	∞	Н	2	36	42	0	37	2	0
40	15	2	ω	49	56	1	50	ω	1
45	25	ω	ហ	61	67	2	63	4	1
50	37	4	∞	73	77	o	74	თ	2
បា	52	7	13	81	85	12	83	œ	4
60	66	10	19	88	90	24	90	11	7
65	78	15	29	93	94	40	94	16	13
70	88	22	42	96	97	58	97	21	23
75	94	31	57	98	99	76	99	29	35
80	97	43	71	99	99	89	99	39	47
85	99	58	84	100	100	97	100	បា	61
90	100	75	93	100	100	99	100	71	76
95	100	89	98	100	100	100	100	88	92
100	100	2					200	100	100







