INVESTIGATION OF WORKPLACE ACCIDENTS IN COAL AND MINERAL PROCESSING PLANTS: UNSAFE ACTS, SAFETY CULTURE AND SAFETY LEADERSHIP

A THESIS SUBMITTED TO
THE GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES
OF
MIDDLE EAST TECHNICAL UNIVERSITY

BY

ESİN PEKPAK FINDIKÇIOĞLU

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR
THE DEGREE OF DOCTOR OF PHILOSOPHY
IN
THE DEPARTMENT OF MINING ENGINEERING

MARCH 2018

Approval of the thesis:

INVESTIGATION OF WORKPLACE ACCIDENTS IN COAL AND MINERAL PROCESSING PLANTS: UNSAFE ACTS, SAFETY CULTURE AND SAFETY LEADERSHIP

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I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

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ABSTRACT

INVESTIGATION OF WORKPLACE ACCIDENTS IN COAL AND MINERAL PROCESSING PLANTS: UNSAFE ACTS, SAFETY CULTURE AND SAFETY LEADERSHIP

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This study aimed at investigating the safety culture, leadership and unsafe acts in coal and mineral processing plants. Safety culture and unsafe act questionnaires specific to the plants in Turkey were developed by literature survey, semi-structured interviews with workers and by receiving the opinions of field professionals. Generated unsafe behavior questionnaire and safety leadership questionnaire translated from a study in literature were applied to 234 plant workers while safety culture questionnaire was applied to 98 coal preparation workers only. The questionnaires proved reliable (Cronbach $\alpha > .8$) and are ready to be used by the beneficiaries willing to monitor the safety culture, safety leadership and unsafe behavior status to take well directed preventive measures and to test the effectiveness of trainings in terms of behavioral change. With this aspect this study has original value being the first in the world providing the first tools to measure human factors in mineral processing. The statistical analyses showed that the unsafe acts were in compliance with Reason’s algorithm. Overtime working had an interaction with the safety culture, leadership coaching and caring, leadership awareness and effort perception of the workers. Safety culture dimension that had the highest effect on lapses and exceptional violations was “communication and

feedback systems”. Violations were affected by safety culture and leadership as expected. No direct/ indirect relationship between safety culture and accidents was detected however there was a limitation in studying relationship between the culture and near misses since near miss awareness has not yet developed in Turkey among plant workers.

Keywords: Workplace safety, mineral processing plants, coal preparation plants, human factor

ÖZ

KÖMÜR VE CEVHER ZENGİNLEŞTİRME TESİSLERİNDE İŞ KAZALARININ İNCELENMESİ: TEHLİKELİ DAVRANIŞ, GÜVENLİK KÜLTÜRÜ VE GÜVENLİK LİDERLİĞİ

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Bu tez çalışması kömür ve cevher zenginleştirme tesislerinde güvenlik kültürü, güvenlik liderliği ve tehlikeli davranışları araştırmayı amaçlamaktadır. Güvenlik kültürü ve tehlikeli davranış anketleri, gerçekleştirilen literatür çalışması, çalışanlarla yapılan yarı yapılandırılmış mülakatlar ve alınan profesyönel görüşleri doğrultusunda Türkiye'deki tesislere özel olacak şekilde geliştirilmiştir. Geliştirilen davranış anketi ve literatürdeki bir başka çalışmadan Türkçe'ye tercüme edilen liderlik anketi 234 tesis çalışanına uygulanırken, güvenlik kültürü anketi sadece kömür yıkama tesislerinden 98 çalışana uygulanmıştır. Anketler (Cronbach α>.8) güvenilir nitelikte olup, güvenlik kültürü, güvenli liderlik ve tehlikeli davranışları takip etmek, bunlarla ilgili hedef odaklı önlemler almak ve eğitimlerin davranış değişikliği sağlayıp sağlamadığını test etmek isteyecek faydalanıcıların kullanımına hazırdır. Bu yönüyle çalışma cevher hazırlama tesislerinde insan faktörünün ölçülmesine yönelik ilk araçların oluşuturulmuş olması nedeniyle dünya çağında özgün nitelik taşımaktadır. Ayrıca, yapılan istatistiksel analizler tehlikeli davranışların Reason algoritması ile örtüştüğünü ortaya koymuştur. Fazla mesai yapmanın çalışanların güvenlik kültürü, lider rehberliği ve ilgisi, lider farkındalığı ve çabası algısı üzerinde etkili olduğu tespit edilmiştir. Unutma ve istisnai ihlal şeklindeki tehlikeli davranışlar üzerinde en etkili olan güvenlik kültür boyutu "iletişim ve geribildirim sistemleri" olarak ortaya

çıkmıştır. İhlal türü davranışların beklenildiği şekilde güvenlik kültürü ve liderlikten etkilendiği belirlenmiştir. Güvenlik kültürü ile iş kazaları arasında direk ya da dolaylı ilişki saptanmamıştır ancak kültür ile ramak kala olaylar arasındaki ilişki ramak kala farkındalığının henüz Türkiye'de yeterince gelişmemesi sebebiyle incelenememiştir.

Anahtar Kelimeler: İş güvenliği, cevher hazırlama tesisi, kömür yıkama tesisi, insan faktörü

To my beloved family and friends,

ACKNOWLEDGMENTS

The author wishes to express her deepest gratitude to his supervisor Prof. Dr. Mustafa Ümit ATALAY and co-supervisor Prof. Dr. Türker ÖZKAN for their guidance, advices, criticism, encouragements and insight throughout the research.

The technical assistance of the experts from the field who gave countenance to preparation stage of the questionnaires by providing feedbacks is gratefully acknowledged. Moreover, special thanks are to be extended to the mining engineers Mücella ERSOY and Ahmet SARIALIOĞLU who organized application of the questionnaires in the field.

The author also wishes to extend her gratitude to Levent Sait İLKAY for his support in preparation of this thesis.

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LIST OF ABBREVIATIONS

NACE	: Nomenclature of Economic Activities
HFACS	: Human factor analysis and classification system
HFACS-MI	: Human factor analysis system-mining industry
ROM	: Run off mine
MSHA	: Mines Safety Health Administration ().
HTA	: Hierarchicalal Task Analyses
FACS-RR	: Human Factor Analysis System-Rail Road
HSE	: Health and Safety Executive (England)
MAPSAF	: Manchester Patient Safety (Manchester University)
SLS	: Safety Leadership Scale
GEMS	: Generic Error Modeling System
SOP	: Standard operating procedures
OHS	: Occupational health and safety
PPE	: Personal Protective Equipment
CP-SFM	: Coal Preparation Safety Culture Matrix
PAF	: Principal Axis Factoring
KMO	: Kaiser-Meyer-Olkin
IV	: Independent Variable
DV	: Dependent Variable
Tph	: Tons per Hour

CHAPTER 1

INTRODUCTION

Coal and minerals are either extracted from the underground or obtained by surface mining methods. All mining activities are considered to be very hazardous according to the disclosure regarding "Hazard classification of work places according to health and safety" [1]. After extraction, coal and minerals are in the form of coarse pieces including impurities. Such constituents in coal, namely ash forming minerals, decrease the calorific value since they do not provide energy in the burning process. In minerals, impurities decrease the quality of the ore. For metallic ores to be treated in mineral processing plants, these impurities constitute the majority of the ore. Minerals and metals are concentrated in mineral processing plants where the valuable minerals and metals are separated from the gangue material to an acceptable extend [2]. Coal is treated in coal washing plants in order to reduce the ash content and to promote effective burning. Coal preparation plants and mineral processing plants are in hazardous work place class with a NACE code of 28.92.03 [1].

Being classified as very hazardous and hazardous respectively, mines and preparation plants are workplaces where many fatal occupational accidents and diseases may take place. Between the years 1829 and 2016, 726 mining disasters (incident with 5 or more causalities) happened in the U.S. In the disasters between 1900 and 2015 12,800 fatalities took place. The last mining disaster in the U.S took place in 2010 [3]. Turkey is far beyond China, the country with the highest coal reserves in the world, when the fatality/ million tons of hard coal produced is considered. In 2008 this fatality rate per million ton of hard coal per person was 7.22

in Turkey and 1.27 in China [4]. In year 2014, 335 fatalities took place in Turkey in 10,026 accidents including Soma Coal Mine disaster with 301 fatalities. In these accidents more than 24,000 workers were injured. Serious accidents take place in metallic mines and quarries as well. More than 23,000 people were injured and 7 died in metallic mines in 1030 mine accidents. More than 1,500 accidents took place in quarries resulting in 56,250 injuries and 38 deaths. It was reported that 271 accidents took place in services supporting mining activities leading to 8,232 injuries and 1 death [5]. These support services include data regarding the preparation and processing plants yet there are no statistical data provided specific to these plants.

There are many reasons resulting in such accidents rooting from unsafe situations and unsafe acts. According to a statistical study [6], in China, the role of human factor in the reasons of fatal accidents in coal mines between 2001 and 2010 was above 94%. This percentage included deliberate violation (35.43%), misconduct of management (55.12%) and defective design (3.54%).

On the other hand, there is a serious effort to preclude unwanted occupational health and safety events. Technical precautions are quite effective in increasing the safety level in a workplace; yet, technology may not suffice to handle all safety issues in a preparation plant. Hence studying the human behavior has a supporting role for the technology and engineering in the continuous struggle for safer and better working conditions. The complex structure of health and safety issues is best framed in Human Factor Analysis and Classification System (HFACS) which includes the unsafe acts, preconditions for unsafe acts, unsafe supervision and organizational influences.

The HFACS was developed in 2003 by Wiegmann and Shappell [7] for the U.S naval aviation mishaps [8] and then was applied in other industries for a better understanding of occupational health and safety. The frame was revised as HFACS-MI (Mining Industry) and used to classify the accident data from underground and open cut coal mines, underground and open cut metal/non-metal minesand quarries between the years January, 2004 and June, 2008 under the details of different levels of the system.

Yet, there are no studies in literature focusing on the effect of human factor on occupational health and safety in coal preparation and mineral processing plants although these plants are hazardous workplaces where even fatal occupational accidents take place. Hence, the main research questions in this study were: "What types of unsafe acts take place in coal and mineral processing plants? How are the unsafe acts affected by safety culture and safety leadership? How are the unsafe acts, safety culture and safety leadership status reflected in workplace accidents? What kind of tools can be provided for the processing plants eager to work on human factor in occupational health and safety? What steps can be followed to improve the safety culture?

In accordance with these questions the objective of this study is to contribute to occupational health and safety in mining by investigating the human factor in coal preparation plants and mineral processing plants.

In order to achieve the goal, the human factor was investigated in three levels of HFACS for a thorough understanding. Firstly, the safety culture level (organizational influences) was determined by the questionnaire developed by semi structured interviews. Secondly, the leadership factor (unsafe supervision) was investigated by application of the safety leadership scale. Finally, the human behavior was covered by the unsafe act questionnaire covering slips, lapses, mistakes and violations based on Reason's approach.

CHAPTER 2

LITERATURE SURVEY

2.1. COAL WASHING AND MINERAL PROCESSING PLANTS

The processes employed from the transportation of the coal/mineral to the preparation plant up to transferring it to the end-use unit are included in the enclosure of coal preparation/mineral processing.

Coal washing decreases the amount of ash, homogenizes the coal and increases the burning efficiency, quality and calorific value of the coal. Hence, through coal washing, products of different burning qualities are obtained for the thermal power plants, iron-steel industryand domestic heating. Coal preparation by reducing the sulfur content of the coal by ash rejection contributes to reduction of air pollution potential of coal burning.

Mineral processing, on the other hand, cleans the mineral/metal of interest from the worthless material to the extent needed by the market. The basic stages in mineral processing are similar to those of coal preparation and include size reduction for liberation of mineral from the discard material and removal of the liberated tailings. The major units in the plants are given below [2]:

Sizing Operations

The size of ore transported from the mine (run off mine-ROM) is reduced to a certain size range depending on the needs of the further stages of processing. In the sizing stage crushers, screens, grinding mills, classification equipment are used and the material is transferred within the plant via band conveyors and pipe-pump systems.

Crushers

In the crushing unit, ore is decreased in size using crushers. Crushers are of different types and capacities (hundreds of tph). Coal or ore enters the crusher through a feeding system, decreases in size by the applied forces in the crusher and leaves the crusher via band conveyors.

Screens

Screens are used to classify the ore in terms of size. The particles with sizes coarser than the screen aperture retain as overflow and may be conveyed to further size reduction (back into the crusher). The particles that pass though the screen aperture are transferred to the next step. Screens may be stationary or vibratory and may have more than one deck depending on the operation. Screening is generally carried out dry but can be applied wet, too.

Conveyors

Band conveyors are used to transfer the coal or ore within the plant. They are long bands made of durable and flexible material (rubber) driven by electric motors.

Grinding mills

When further size reduction is necessary for liberation of the ore from discard, grinding mills are used. They are widely used in mineral processing but rarely used in coal preparation. A mill is cylindrical equipment revolving around its axis to decrease the size of the ore to smaller dimensions by cascading and cataracting the material with the grinding media within. Here the size of ore particles is reduced drastically to micron sizes.

Generally, grinding is carried out under wet condition. Thus water is introduced into the grinding mill. When the transported material is in slurry form transportation is carried via pump pipe systems.

Classification Unit

Screen-Crusher relationship is valid for mill-classifiers. A wide variety of classifiers are employed for size classification of the mill product. Since water is almost always included and smaller sizes are dealt with, size classification has to be made more complex systems are included than screening. Generally cyclones and less commonly mechanical spiral classifiers are used to classify the ground material in terms of size.

Coal Washing and Concentrating Unit

The size reduction and classification stages are applied to preparae the suitable feeding material for this unit. There are a wide variety of methods used for coal cleaning. The most common method is dense medium separation. The fluid that the coal passes through is increased in specific gravity, so that clean coal with density lower than the medium will float over and the ash forming minerals will sink down and be separated due to their high density. This process takes place in small tanks or tumblers sequenced in an order. For medium size coal cleaning, spirals and tables are used where the denser ash forming material is separated from lighter coal particles. For fine coal cleaning, froth flotation method that functions based on surface physicochemical differences between coal and ash forming minerals is applied.

Similar methods are employed for the mineral processing depending on the type of the ore. Gravitational concentration methods may be used depending on the concentration criterion calculated based on the specific gravity of the mineral, the tailing and the medium to be employed. For instance shaking tables are used widely for chromite. Jigs are used for alluvial deposits. Froth flotation find a wide variety of applications in mineral processing being especially used for copper and lead bearing minerals. In addition to these, hydrometallurgical applications are also included in mineral processing.

Finalizing the Product

After the ore is cleaned and concentrated to the desired quality (grade or calorific value) in cleaning and concentration operations, it is prepared for shipping. The concentrated ore or coal products are dried and stored in silos, stock piles. From these storage facilities, they are transported by trucks or rail systems [2].

The common tasks in a well organized preparation plant are [9]:

- Cleaning and clearing the area around the crushers and screens,
- Removing the material falling from band conveyors,
- Unclogging chutes, feeders, crushers,
- Recharging the mill media (generally in mineral/metal processing plants),
- Checking operability of the units,
- Carrying out periodic maintenance of equipment,
- Carrying tools and materials in the plant
- Repairing equipment in case of a break down,
- Taking samples from different points of the flow to test the performance of the unit

2.2. OCCUPATIONAL SAFETY IN MINING AND COAL AND MINERAL PROCESSING/PLANTS

2.2.1 *Work Accidents in mines and coal and mineral processing plants*

Coal mining and safety relationship has been studied by many researchers. The accident records in coal mines date back to 1870's in England [10]. There is plenty of data about work place accidents in coal mines in the U.S.A reported by Mines Safety Health Administration (MSHA). According to Perez (2013), in 2012, 12 fatal accidents and 25 partial permanent disablements took place in underground coal mines in the U.S.A, while 1692 temporary disablements occurred. Perez [11] also reported that 1 fatal accident, 131 non-fatal accident with work day losses and 81 no days lost accidents took place in coal washing plants in U.S.A in 2012. According to a study by the U.S. Bureau of Mines nearly 85% of all mining accidents identified human error as a causal factor. Patterson (2010), [8] states that in order to improve safety, to study the effect of human error on mining accidents has vital importance.

Some common accidents in preparation plants are [12] [13] [11] [14]:

- Falling down, tripping, slipping, being squeezed under the pile and hitting a limb somewhere while unclogging equipment ,
- Being hit by falling material from the band conveyor or squeezing a limb while cleaning around the band conveyor or screen,
- Falling down, tripping, slipping and hitting a limb somewhere while taking samples,
- Getting electric shock, getting a limb smashed under heavy parts, having a limb squeezed,
- Getting skeletal shock due to carrying high loads during media addition to the grinding mill,
- Falling down from height in works at height,

Moreover workers are exposed to dust, noise and vibration in processing plants.
Seven fatal accidents from that took place in U.S.A in coal preparation plants between years 2004 and 2014 are listed in Table 2.1.

Table 2.1. Fatal accidents in preparation plants in U.S.A (2004-2014)

Year	Cause of death	Explanation
2004	Burried under pile of coal	The operator with 31 years' experience failed to recognize that the coal walls in the stockpile were to impend and to slide on him [15].
2007	Electric Shock	The operator received electric shock although the tag-out, lock-out system was being used. He was supervising the contractor repairing the motor of the band conveyor while working on a loose electric cable. The operator relying on the shut down and lock-out he applied starts working without controlling the electric current upon failure to identify the risk of accessing electrical installations [16].
2007	Fall down from height	While carrying out repair maintenance work at height, an operator trying to reach the impact wrench that fell on a metal ledge against the wall fell down from the third floor of the preparation plant. There was personal protective equipment against falling from height in different sizes and at 7 different points in the plant. A tool box training titled "Protection from injuries of slips and falls" was carried out before the shift [17] .
2009	Burried under pile of coal	The truck driver inadvertently or intentionally opened the chute above before time with a remote control and 10 tons reject material fell on the cabin crushing him. First line of sensors was obscured by the truck and the second line was not working properly due to dirt [18].
2011	Electric Shock	A contractor worker contacted with an energized welding electrode while working on pipes at some height above the filter floor [14].
2012	Fall down from height	A worker fell from a ladder while removing an overhead beam. One of the root causes was that the management did not ensure usage of complete ladders in good condition in accordance with the recommendations of the manufacturers [19].
2013	Struck by an equipment part	A worker was sent to the press filter to report a problem with the equipment so that trouble shooting could be made. However, the press cylinder ruptured and killed the worker. [13]

2.2.2 *Studies Related to Occupational Health and Safety in Mines and Processing Plants*

Nie et al.'s (2011) [20] work on a safety management system in a coal preparation plant is one of the few studies in coal preparation plants. According to this study coal preparation plants were reported to have individual safety evaluation methods but no systems were implemented. In order to provide a systemic approach, Nie et al. [20] classified the plant into units and recommended best fitting assessment methods for each unit. Yet, none of the techniques offered included the human factor side of occupational safety.

Chen et al. (2011) [21] focused on assessment of safety culture in coal enterprises. In the study, a fuzzy overall evaluation model was introduced. Three coal mine enterprises in China were fully analyzed and ordered in decreasing safety cultural level. Chen et al (2011) [21] obtained a weight factor for each safety culture indicator and subtitles of these indicators, to evaluate their contribution for development of the safety culture. These weight factors provided a qualitative expression for the safety culture. The level indicators of safety culture were organizational commitment, management participation, staff authorized, rewards and punishment system, reporting system and education and training. The highest weight factor was obtained as 0.257 for education and training followed by rewards and punishment with a weight factor of 0.203. This study was the first safety culture study in mining area and hence provided important information on how to approach safety culture in mines; yet, processing plants were not handled in this study although they are a part of mines in terms of culture but also are quite different than rest of the mine when the operations are concerned.

Stanton (2006) [22] prepared an extensive review on hierarchicalal task analyses (HTA) in a coal preparation plant. An output analysis for a coal preparation plant including information from technical system to the operator and the flow of information in the reverse direction was improved. This study was important since it was the first one working on human factor in a coal preparation plant. However, the study concentrated on the basis of ergonomics and mainly on the human computer interface interaction. Hence, it worked on task analysis in case of shut-down and start-up procedures and did not cover related unsafe acts or the factors affective on these acts.

2.3. HUMAN FACTOR ANALYSES AND CLASSIFICATION SYSTEM (HFACS)

HFACS provides a theory-driven structure to accident, incidentand close call (near miss) investigation. Moreover, instead of blaming the individual, HFACS framework focuses on all the contributing factors to clearly understand the deeper systemic problems.

The system was developed in 2003 by Wiegmann and Shappell [7] for the U.S naval aviation mishaps [8]. The levels in the model were: unsafe acts committed by aircrew (active failures), preconditions for the unsafe act (latent factor), unsafe supervision (latent factor) and organizational influences (latent factor). These basic levels were subdivided into lower categories for more detail. In the HFACS, human error is covered under the unsafe acts level together with violations. Later on the system was expanded from military to commercial aviation areas.

The model found application in railway sector as well [23]. Federal Railway Administration, modified the original format of HFACS by adding “outside factors” as a main level and organizational contraventions under the organizational influences. Indeed they replaced the word “violation” with “contraventions” and added a third violation to routine and exceptional violations: sabotage acts. They also changed the term “unsafe acts” to “operator acts”and applied the system as HFACS-RR (RR standing for railroad) for the railroad accidents and close calls.

In 2010 the system was applied in mining industry. Patterson (2010) [8] modified the system in accordance with mining sector and generated HFACS-MI (
Figure 2.1). HFACS-MI used outside factors layer consisting of regulatory oversight, government policies. The “other factors” at this layer included economic pressures, political conjunctureand social and environmental sensitivities. The organizational influences layer covered climate, operations and resource management. The climate stood for the dominant atmosphere regarding policies, command structure and

culture. The organizational climate at this layer was certainly inclusive of the safety culture. The third layer effective on human factor was unsafe leadership. Unsafe leadership appeared in the form of inappropriate oversight, management of the personnel in terms of health and safety, failure to correct the problems faced, etc. Next layer constituted the conditions paving the way for unsafe conditions. These conditions were considered to take place due to environmental factors; physical, mental or psychological state of the operator or personnel factors. The unsafe acts covered errors and violations which will be discussed in detail in further sections of this study. Patterson (2010) [8] and her team worked on 508 mine accidents (2004-2008) data from metal/non-metal minesand quarries.

The team listed all causes included in these 508 accidents and matched them up with different levels of HFACS-MI. According to this study, organizational climate was a cause in 1.4% of the accidents, unsafe leadership was a factor in 36.6% of the accidents and unsafe acts were prevalent in 94.7% of the accidents. Unsafe acts contributed with a share of 481 events. There were 299 skill-based errors and 249 decision errors. Preconditions for unsafe acts (majorly technical environment, physical environment and coordination-communication) were responsible for 416 incidents. Unsafe leadership contributed with 186 incidents while 49 organizational influences were determined. This thesis study utilized safety culture (included in organizational climate), unsafe leadership and unsafe acts layers of this system.

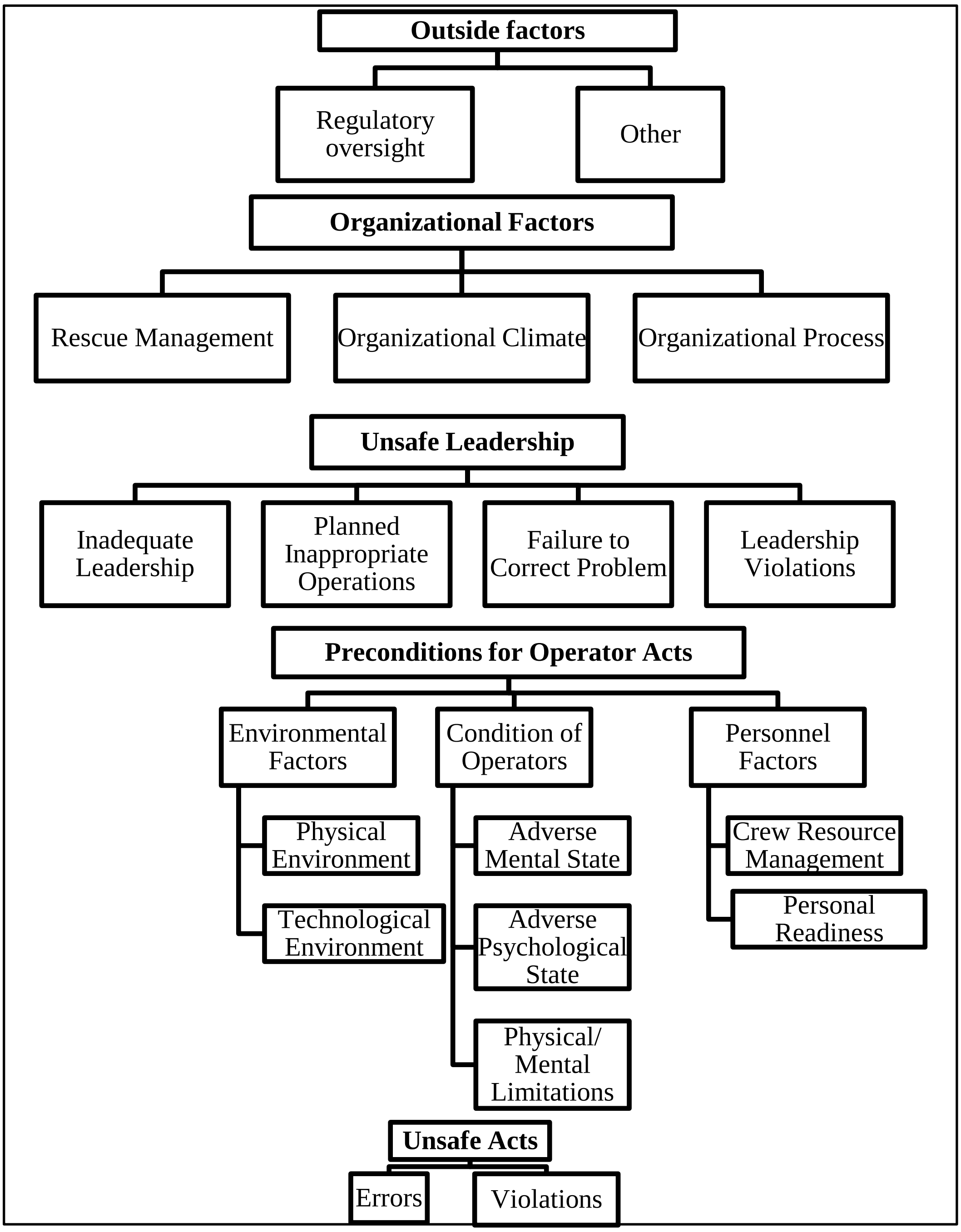

Figure 2.1 Human Factors Analysis and Classification System-Mining Industry (HFACS-MI) framework [8]

Skalle et al. (2014) [24] adopted the system approach and classified the factors contributing an accident as "Human & Organizational (H & Org) Error", "Technical

Error” and “Organization Safety Level”. In this study, the latent errors were attributed to designers as well as the management. It was mentioned that active failures were inheritances of these latent errors. In the study on integration of human error with technical errors contributing to the accidents in the off shore oil industry, observations of the supervisor were related to unsafe results in different ways. The relations would be one of the following: “causes always”, “causes typically”, “leads to”, “implies”, “causes sometimes”, “enables”, “involves”, indicates”, “causes occasionally” and “reduces effect of”. These relations had strength levels between 0.3 and 1.0. For example fatigue and workload “has a subclass” of management related fatigue factors, which has a subclass of less than ideal motivation” with a subclass of inattention “leading to “few wellbore problems expected “involving” oil based muds. This gave a path strength of 0.32. In a similar manner path strengths were calculated for different human errors. From this study safety culture had a path strength that is more than 10% in the human error indicators. Rule based, knowledge based and skill based errors were branched down to 22 subclasses for the oil industry in the study.

As mentioned earlier unsafe act may not be attributed to one individual. Hence, firing one employee committing an error would not be solution real systemical problems. Therefore, HFACS may be used to improve paper based tools to help the investigators [23], occupational safety professionalsand inspectors to collect and to analyze data. Moreover, this approach may be used to determine the effectiveness of interventions and the observe improvements when applied periodically. HFACS is a multi layered system to be used for a comprehensive understanding of health and safety. Safety culture (included in organizational climate), unsafe leadership and unsafe acts layers of HFACS-MI covered in the scope of this thesis study will be discussed further in the following sections. The outside factors were excluded from the study since these factors are not under control of the workplaces hence it would not be possible to come up with solutions that could be applied right away. For the preconditions for operator acts level a rather extensive stıdy based on observation for long term would be required which would be beyond the scope of this study. The weaknesses detected in safety culture, safety leadership and unsafe acts layers on the other hand could be overcome by administrative measures right away.

2.4. SAFETY CULTURE

The studies in the area of health and safety showed that technology does not suffice alone in prevention of all health and safety incidents. Thus, working on the safety culture would support health and safety applications [25] .

The workers may comply with or resist health and safety rules and regulations. Resistance to such rules and regulations result in unsafe acts and certainly not all the unsafe acts lead to occupational accidents. Sometimes they give rise to near misses or close calls not causing harm. Some other times unsafe acts earn time for the worker or can make the task less tiring. This causes such acts to gain contagious property and spread quickly among workers [26].

Safety culture, by affecting the concepts in the mental models, ethical values, approaches, emotions, thoughts of the workers causes the safe behaviors to be internalized. Once the safe behavior is internalized shortcutting between tasks to gain time and making less effort would be secondary to safety. The safe behavior can be promoted by punishment and reward approach, trainings, team working which in turn results in an active safety from passive safety where complying with the rules changes to safe behavior [27]. It is essential that "safety is everyone's job" phenomenon to be adopted at all levels of the organization including managers, supervisors and workers [28]. A comprehensive definition of the safety culture could be: the beliefs, values, attitudes, experiences, norms, interpretations, assumptions, responsibility perception, behavioral patterns, commitment to and efforts to enhance health and safety that is shared everybody working in the workplace and that shapes the behaviors towards risks and the precautions taken against risks [29] [30].

2.4.1 *Measurement of Safety Culture*

It is not right to distinguish workplaces as workplaces that have safety culture and the ones that do not have safety culture. The safety culture matures passing through different stages. Although the safety culture is not a concrete concept it enures in every task carried out in the plant [26].

The measurement method for safety culture depends on how it is defined and the approach to that definition. Safety culture can be measured by qualitative and quantitative methods. Conventionally organizational culture is studied by qualitative methods such as observations and interviews [26]. While, quantitative methods are based on questionnaires that are evaluated statistically. Psychological and behavioral dimensions can be studied both qualitatively and quantitatively. Both types of methods have a potential to evaluate and test the theory [31].

The questionnaires have been widely applied to measure the safety culture. Questionnaires are practical to apply and provide the opportunity to make comparisons between groups. However, questionnaires are found insufficient in relating the culture to behaviors and are not reproducible [32]. The questionnaires might be limited in terms of the options to be picked. When the participant feels difficulty in relating himself/herself to the choices provided, the reproducibility and reliability of the multiple choice questionnaire might decrease. Hence, the questionnaires should be prepared in a way where the participant will easily relate to the choices. A good way to ensure this quality is to carry on interviews and receiving the opinions of the professionals prior to preparing the questionaires so that the situation that participants face with can be well reflected. That is why the tools provided in this study are generated via interviews with the workers and the questionnaires prepared were checked by the occupational health and safety and mineral processing professionals.

Qiao et al. (2005) [33] evaluated the data from the questionnaire applied in coal mines by fuzzy systems. In a study carried out by Lu and Chen [34] a safety culture questionnaire was applied to 306 mine workers from public establishments to evaluate the rule following behavior. The results obtained from the questionnaire were evaluated in fuzzy systems as well. Adoption of fuzzy systems could be interpreted as a quest for handling the complicated structure of the safety culture. Fuzzy systems might have been expected to compensate for the limits of a multiple choice questionnaire.

According to Parker (2009) [35] the safety culture has such a complex structure that is not possible to evaluate it by a single score. The method to be used to evaluate the safety culture should be multidimensional so as to be extensive and to reveal the complicated picture of strengths and weaknesses of the workplaces. Safety culture maturity level based studies comply with this complex structure. The studies that make use of safety culture maturity model determine the current safety culture level of the workplace and provide the steps to be taken to improve the safety culture [36].

Foster and Hault (2013) [37] took the method one step further by combining it with quantitative evaluation where the output of the field study was used as an input for a questionnaire to be applied. This method brought the advantages of qualitative approach and quantitative method together. For the workers to relate to the items provided in the questionnaire it is essential to be attentive to use the specific jargon used commonly in plants. Cooperating with the professionals from the field to employ the right wording is of importance. The job specific jargon was included in the tools developed iin this thesis study by the help of the interviews and professional checks.

2.4.2 *Safety Culture Maturity Model*

The safety culture maturity model applied in different areas such as offshore oil industry, mining and medical sectors can be credited back to Reason (1997) [30]. The model was further elaborated by Hudson (1999) [38], Westrum (2004) [39] and

Parker (2006) [40]. According to this model the improvement of the safety culture can be analyzed at five different levels for varying dimensions. The safety culture maturity levels are: namely pathological, reactive, bureaucratic, proactive and generative. The explanations for these levels are provided in Table 2.2.

Table 2.2. Safety culture maturity levels

Safety culture maturity level (approach)	Explanation
Pathological (Why spend time and money on safety?)	There is no interest in occupational health and safety. The major causes of accidents are thought to be carelessness, inattentiveness and violation of rules. A scapegoat is sought in case of occupational accidents [39]. There is no safety communication [38]. Information is important only when it serves for the interest [32]. The approach to safety issues is "accidents happen, the job is dangerous". The workers are intimidated about the communication on occupational safety issues [35].
Reactive (Occupational accidents are important, we do what is necessary when an accident happens)	The occupational accidents are taken seriously upon an incident. The awareness increases upon the accident but ceases with time. The feed backs related to occupational safety are not welcome. The individuals communicating about safety are not accused but are ignored. There is no system to deal with risks. Tasks related to safety are chaotic. The safety responsibilities are not well defined.
Bureaucratic (We have systems established)	There is system established to manage the risks. The occupational safety practices are seen perfunctory. The management is good in terms with regulations, numbers and systems. There are many forms, records and statistics to show that the firm is good at safety issues. Everything looks good on paper but safety is not internalized. Roles are well defined but are used to avoid responsibility.
Proactive (We prevent accidents by taking precautions)	The risks are dealt with beforehand. Precautions regarding probable accidents are taken. The feedback regarding safety issues are taken into account. The workers communicating on safety are encouraged. There is a sound communication network. The responsibility around safety is shared.
Generative (Safety is an intrinsic part of every work done here)	Occupational safety practices are internalized and well adopted [38]. Information is sought. Failures are seen as opportunities to improve safety. New ideas are welcome. High standards of occupational health and safety are adopted by everyone. Workers and managers are honest about mistakes. Everyone in the workplace is responsible for safety.

Fleming (2007) [36] developed the safety culture model for the off-shore oil industry and reported the results to Health and Safety Executive (HSE). The model was applied in oil industry by Parker et al. (2006) [40]. The method was applied in a coal mine in the UK to reveal the strengths and weaknesses with the tool developed (Mining Industry Risk Management- Maturity Chart). This final study proved the method practical and useful to apply [37].

Furthermore, the method was applied in medical sector in the Manchester University as a tool (MaPSaF) to measure the patient safety. MaPSaF was the first tool developed to measure patient safety [35]. MaPSaF evaluated the safety culture in nine dimensions determined specific to the branches like acute, primary care and ambulance separately.

In safety culture maturity model the safety culture levels (pathological, reactive, bureaucratic, proactive and generative) constitute the columns of a matrix while the occupational health and safety dimensions constitute the rows. The dimensions should be specific to the area of study hence they should be determined via investigation. The dimensions used in different studies are given in Table 2.3.

Table 2.3. Safety culture dimensions in literature

Researchers	Dimensions
Fleming (2007) [36](Oil industry)	1) Commitment to safety 2) Training 3) Communication 4) Safety performance evaluation 5) Workforce involvement 6) Job conditions 7) Organizational learning
Parker et al. [40] (2006) (Oil industry)	1) Benchmarks, trends and statistics 2) Audits and reviews 3) Incident / accident reporting; investigation, analysis 4) Hazard / unsafe act reports 5) Work planning 6) Contractor management 7) Competency, training 8) Work site job safety techniques 9) Safety checks 10) HSE department 11) Reward system
Parker (2009) (Health industry-Patient Safety-Ambulance)	1) Commitment to continuous improvement 2) Priority given to safety 3) What causes patient safety incidents? How are they identified? 4) Investigating patient safety incidents 5) Organizational learning following a patient safety incident 7) Communication 8) Staff education and training and safety issues 9) Team working and safety issues
Foster and Hault (2013) [37] (Mine Industry)	1) Leadership and accountability 2) Policy and commitment 3) Risk and change management 4) Legal requirements 5) Objectives, targets and performance measurement 6) Training, competence and awareness 7) Communication and consultation 8) Control of documents 9) Operational controls 10) Emergency procedures 11) İncident investigation 12) Monitoring, auditing and reviews

The cells of the matrix (Table 2.4) are filled up in the interviews carried out with workers. During the interviews the questions prepared to gather information about each intersection of culture levels and dimensions are asked either in an order or according to the state of play of the interview.

Table 2.4. Safety culture matrix template

Levels / Dimensions	Pathological	Reactive	Bureaucratic	Proactive	Generative
Continuous improvement of occupational health and safety					
Priority of occupational health and safety					
Occupational accidents / Near misses and reporting such incidents					
Investigation of occupational accidents /near misses					
Learning from occupational accidents /near misses					
Communication and feedback systems					
Occupational health and safety trainings					

The questions of the semi-structured interview for the current thesis study were addressed in the following form for each dimension and safety culture maturity level intersection where the underlined sections are changed for each cell:

"How do you think occupational health and safety is improved continuously [dimension 1] in a mineral processing plant with approach "Why spend time and money on safety?" [pathologic level] to safety"

The preparation of the matrix by interviews is the qualitative part of the work. While, applying the questionnaire obtained by converting the matrix is the quantitative part. In order to convert the matrix into a questionnaire, the columns of the matrix i.e. the safety culture maturity levels, are given as the choices for the question "Which of the following choices is closest to the plant you are working" for each dimension.

2.5. SAFETY LEADERSHIP

Safety leadership is considered effective in decreasing human error and incidents; indeed management leadership is regarded as a key element in safety in workplaces [41]. It is defined as ‘‘the process of interaction between leaders and followers, through which leaders can exert their influence on followers to achieve organizational safety goals under the circumstances of organizational and individual factors” by Wu (2008) [42].

The leadership studies focused on different leader groups from managers, senior managers to supervisors. There are a few safety leadership practices listed in literature. For instance according to Carrillo and Simon (1999) [43] there are six crucially important practices: 1) to make the case for change, 2) to create a shared vision, 3) to build trust and open communication, 4) to develop capabilities, 5) to monitor progressand 6) to recognize accomplishments.

In another study conducted in off shore oil production worksite the most critical leadership practices were revealed to be visibility at the worksite and leading by example; developing open, honest and trusting relationships with the workforce; workforce involvement and empowerment in planning and decision-making, thereby increasing workforce ownership and responsibility of safety performanceand being proactive about safety [36].

The safety leadership studies make use of scales developed and tested for reliability. In a study conducted in Taiwanese University [44] a highly reliable scale (Cronbach Alfa =0.971) was developed and was named as safety leadership scale (SLS). The subscales were determined as safety coaching, safety caring and safety controlling. The scale included 19 items covering afore mentioned leadership qualities.

2.6. A GENERAL OVERVIEW OF BEHAVIORAL SAFETY

It is a fact that engineering solutions are quite effective in elimination of occupational hazards and risks but they do not suffice in all types of safety issues. Behavioral safety approaches remain important specifically when risky behaviors persist even after all such controls have been implemented [45]. Indeed, in practice human errors are considered to be involved in all accidents [24]. This realization puts an emphasis on the human factor in occupational safety.

Behavioral safety dates back to 1930s when Herbert W. Heinrich claimed that considerable amount of the injuries that occurred at work were due to unsafe actions of the workers. For the reduction of such incidents Heinrich suggested that human based solutions be employed to support engineering solutions. Several studies working on effectiveness of human factor based interventions on injury reductions supported this view [45].

Although human error plays a major role in occupational accidents, the situation should not be interpreted as the operators are to blame as the sharp end. Focusing merely on the individual is not considered as effective as adopting a systems approach [46]. Operator's act is considered as the visible active part of what happens in a work accident. The error committed by the one on the sharp end of an operation is called an active error. This type of error takes place closest in time and physical space to the accident, incident or close call [23]. Nevertheless, there are also latent errors arising from manager decisions, unsafe situations not revealed until they coincide with an active error. Latent factors are rather organizational than individual.

According to Reason (1993) [29] the latent factors resemble the latent pathogens in the human body not taking over or even realized until one day a condition triggers their upcoming. As a result incidents regarding occupational safety are prevented when this alignment of active and latent are prohibited by the defenses or barriers.

2.6.1 *HUMAN ERROR AND VIOLATION*

Errors and violations are distinguished by the “intention” concept and are dealt with by significantly different solutions than each other. Error is defined as an action that cannot achieve the intended goal. On the other hand, violations are committed “willfully” [46]. According to Reason (1993), errors take place based on cognitive processes of individuals whilst violations are related to the social context [29].

Errors are rather difficult to detect since they are committed unknowingly and the one committing the error is unaware of the situation [46]. Furthermore, errors are viewed as symptoms of the fallacies in the higher levels of organizations and as consequences rather than causes [47]. Thus, it is significantly important to get an understanding of the context that brought about the error in order to have a control on its reoccurrence [48]. Here, good classification of the human error would come in handy.

Norman (1981) [49] was the first researcher to differentiate slips from mistakes within human error concept. Embrey (2005) shared a similar approach [50]. Rasmussen (1986) [51] classified human error into three as: skill-based, rule-based and knowledge-based (SRK approach) errors while Reason [52] took the classification one step further bringing in slip, lapse, mistakeand violation classification in his studies. The intention situation, together with the level of conscious control over activities was used to define the type of human error [50]. Figure 2.2 displays the classification of human error according to Reason (reproduced from Embrey (2005) [50] and Oppenheimer and Shinar (2005) [53]).

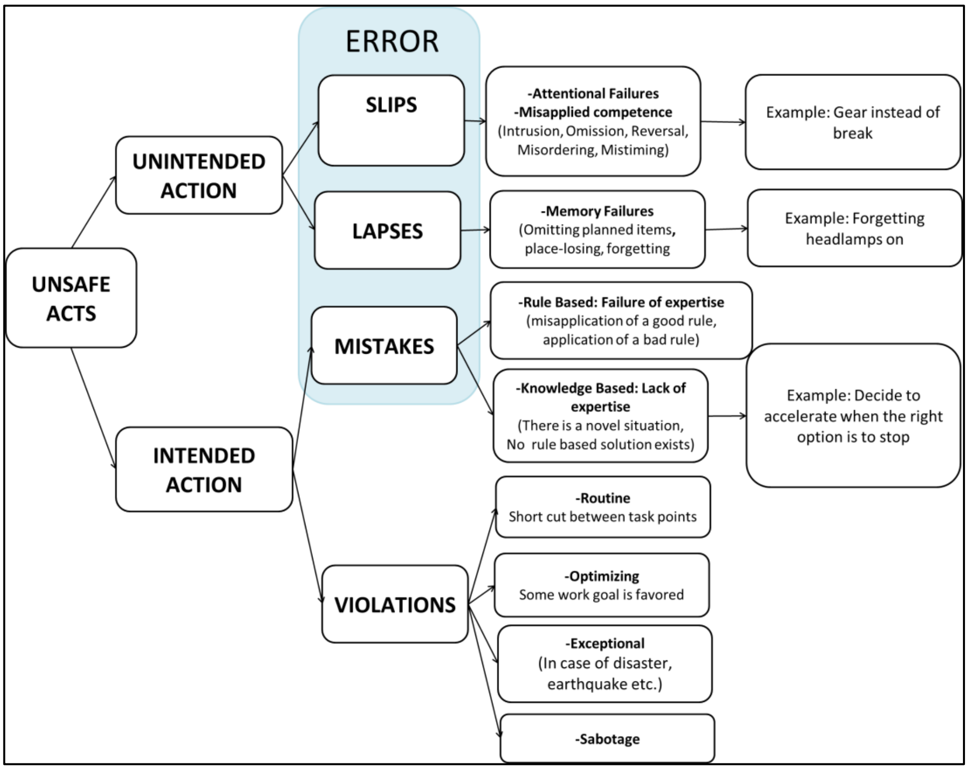

Figure 2.2 Classification of unsafe acts

In Skalle's (2014) [24] study an additional intentional status was added as "non-intentional" behavior which implies the activities that are involuntary. In this study intentional and non-intentional activities were regarded as active errors while unintentional errors were seen as latent errors.

In the study carried out by Patterson (2010) [8] where 508 mine accidents between years 2004-2008 were investigated for human factor at different levels as a part of HFACS-MI, it was seen that 94.7 % of the cases were associated with unsafe acts. The most common error type was skill based error ensued by decision errors, violations and perceptual errors for all the years except for 2008. It was found that in 2004, 6 out of each 10 cases included at least one skill-based error while 5 of each 10 were due to decision error. At least one violation and perceptual error were involved in only 1 out of every 10 cases.

The reasons producing errors and violations vary greatly. The conditions inviting error can be summarized as high workload, inadequate knowledge / ability / experience, poor human machine interface design, inadequate supervision/instruction/leadership, stressful working environment, mental state of the operator (fatigue / boredom). The conditions preparing the background for violation are lack of safety culture, poor morale, over optimistic beliefs about bad outcomes, violation condoning laws, macho attitudes of the workers, meaningless rules applied [48].

Since the reasons and sources for different type of unsafe acts vary, the soltions should vary as well. It is possible to reduce errors by periodic trainings, memory aids, user-friendly human-machine interfaces. On the other hand, reduction of violations relies on remedies aiming at changing attitudes, norms, beliefs which is possible by a shift in safety culture [53]. However, certainly the first step should be the detecting what type of unsafe acts are prevalent in a workplace.

2.6.1.1. *Skill Based Error*

Skill based responses are automatic in a sense and necessitate little or no conscious attention put into work i.e. no cognitive monitoring is needed [24] . In such responses decision making is simple [46] and little feedback is seen sufficient [50]. The activity is highly practiced thus only the physical skills developed and hand-eye coordination is needed. Skill based activities are characteristically reapplication of past experiences whenever needed. Previous experiences and familiar information are processed quickly. Since preprogrammed behavior sequences are ready to use, conscious attention of the mind is not required [50]. Embrey (2005) [50] stated that these responses were initiated by a certain event; for instance operating a valve due to a procedure and then the task is automatically performed with little or no conscious thought.

Skill based errors occur when a momentary attentional slip takes place in routine actions in familiar environment. They may be classified as attention failures, memory failuresand technique errors. Some of the skill based errors in railway conducting are visual scan pattern breakdown, turning switches on/off in an unmeant manner, omitting items in checklists [23]. Such errors may also be seen in use of tools, equipment and personal protective equipment and occur when skills do not suffice for the goal oriented task [8]. Moreover, not changing the habits in accordance with the situation changes may produce skill based errors [50].

The skill based errors are classified as “slips and lapses” in another study in a similar way [24]. Slips are attentional errors. In slips the intention is correct but a failure takes place during the activity to achieve the task. Slips are seen as misapplied competence. When the process is smooth, known to the operator and automated, the goal is expected to be reached by application of automatic behaviors [24]. Nevertheless, when there are unfamiliar activities included in a familiar context and distractions take place; slips are to be expected. Lapses are memory failures and the action is not carried out at all. A good example to explain slips is stepping on the break while driving instead of stepping the gas pedal of the car. While leaving the headlamps of the car on exemplifies lapses. When a worker treats the wrong reactor next to the actual one to be treated, a slip may have occurred or the reactors are poorly labeled [50]. When the worker completely forgets to treat a reactor he is said to have had a lapse.

2.6.1.2. *Rule Based Error*

Rule based responses resemble skill based responses in their largely automatic nature [46]. However, this time the source of action is the learned rules rather than internalized practice. The level of conscious control is more than the skill based case [50]. The rules are learnt in theoretical trainings, hands on trainings or by working with experienced operators. There is an intended action but the intended plan is not right. Rule based response takes strength from previous successful applications of the rule [24].

Rule-based errors, mistakes, occur when the rule is not known well, when the situation is not evaluated correctly and the rule that does not match the situation is applied. They are less common than slips and lapses but are more difficult to identify and are more dangerous [24].

Decision making in the rule-based level is more complicated that in the skill based. There is a stage that the operator refers to the rule repertoire to select the appropriate rule before taking action. If the rule that matches the situation correctly is picked, the goal is achieved. Nonetheless, either going with the wrong rule or failing to apply the right rule in correct way leads to error. Thus, the situation should be categorized correctly [46]. Mistakes arise from the planning level not the action level. There may be a tendency to mold the situation to comply with the known and previously successfully applied rules.

There are also the decision errors seen in literature explained to be somewhere between knowledge and rule-based errors. In decision error the behavior towards the goal is conscious however the plan turns out inappropriate for the case [8]. Decision errors are categorized as: procedural errors, poor choices and problem solving errors [23]. They were mostly seen as procedural errors but misinterpretation of the information may also be seen. The operator is assumed to know the procedures yet he/she may not know or may have started to forget it. Other than that, in the mine, the operator may fail to assess the hazards correctly and to take the right action. This usually occurs when operators underestimate the risk of their decision [8].

2.6.1.3. *Knowledge Based Error*

Mistakes may also occur on the knowledge based level. Here in knowledge based response, cognitively an analytical process takes place. There is considerable effort.

Conscious mental activity is high and decision making is complex. The conscious thought in this mode is best understood when an inexperienced operator performs a task or when an experienced one faces a novel situation [50]. There is a considerable mental effort and responses are slow. The unfamiliar issue should be identified and possible outcomes should be determined continuously while trying to choose the right strategy to handle the situation [46]. Feedback from the applied strategy should be evaluated [24].

Experience is important in knowledge-based performance and it "*can neither be taught nor substituted for – it merely comes with time"* [8]. In knowledge based errors wrong intentions may come up due to lack of knowledge or incorrect evaluation of the situation. Having operational blindness and overconfidence in the correctness of the knowledge produce such wrong intentions [50]. Moreover; workload and stress negatively affect the success of knowledge based responses [50]. Knowledge based errors may also come up when the operator focuses on only one aspect of the situation ignoring others.

A typical example for knowledge-based errors may be accelerating the car while the right choice would be stopping the car to avoid a crash. Sometimes wrong decisions may be made when there is more than one situation and all the situations are considered superficially but none is completely handled [50].

Patterson (2010) [8] who studied human factor analysis and classification for mines defined another error called perceptual errors: These errors arise when sensory input is degraded as is often the case when working underground, in poor weather, around noisy equipment, or otherwise sensory impoverished environments. Dusty and noisy working environments do exist in some of the preparation plants.

2.6.1.4. *Violation*

The violations are classified into different categories in the literature. Most comprehensive categorization classifies violations into 4 as routine, optimizing, exceptional and sabotage.

Routine violations are also referred to as "bending the rules". This type of violation is rather habitual. Such violations take place when the management system is tolerant to rule invasion.

Optimizing violations are committed when the working goal is prioritized over safety. These violations may even be encouraged by the management.

Exceptional violations are voluntarily breaking the rules in case of an extreme situation like a natural disaster or if one are in serious danger.

Sabotage type violations are committed willingly to give harm to the establishment.

2.6.2 *Step Ladder Model and GEMS (Generic Error Modeling System)*

There are distinct differences between different human errors. Yet, in the course of a problematic task the operator may pass through these three response stages (namely skill-based, rule-based and knowledge-based). Rasmussen (1986) [51] came up with the step laddering model (Figure 2.3) to systematically explain this flow of responses. In Figure 2.3, the dotted lines show the usual short cuts that allow particular stages in the information processing sequence. On the other hand, the solid lines represent the regular path to follow. For example to reach the knowledge-based stage the worker passes through the boxes below. Immediate recognition of the problem will lead the operator to respond on the skill-based level. However, if the problem is not that obvious rule based level is referred to and then application of the procedure is again at the skill-based level. If the problem is rather novel and the rules do not come in handy and a unique solution is to be searched for situation evaluation and planning would be needed which lies in the knowledge-based level. The dotted lines stand for the feedbacks from the system.

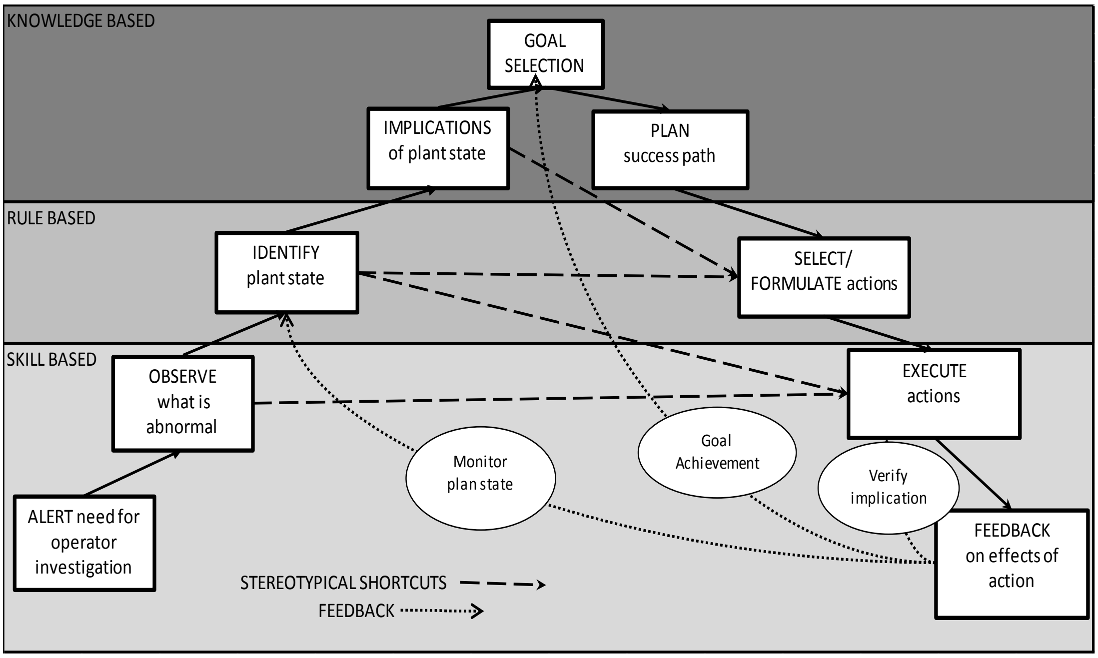

Figure 2.3 Decision-Making Model (adapted from Rasmussen (1986)) including feedback [50]

What is more, Oppenheim and Shinar (2011) [53] combined the work of Rasmussen (1986) [51] with the hierarchicalal model of Michon (1985) [54] for a thorough understanding of GEMS. GEMS aims at describing how one passes from one stage of information processing to another (skill, rule, knowledge) while performing a task (Figure 2.4) [50].

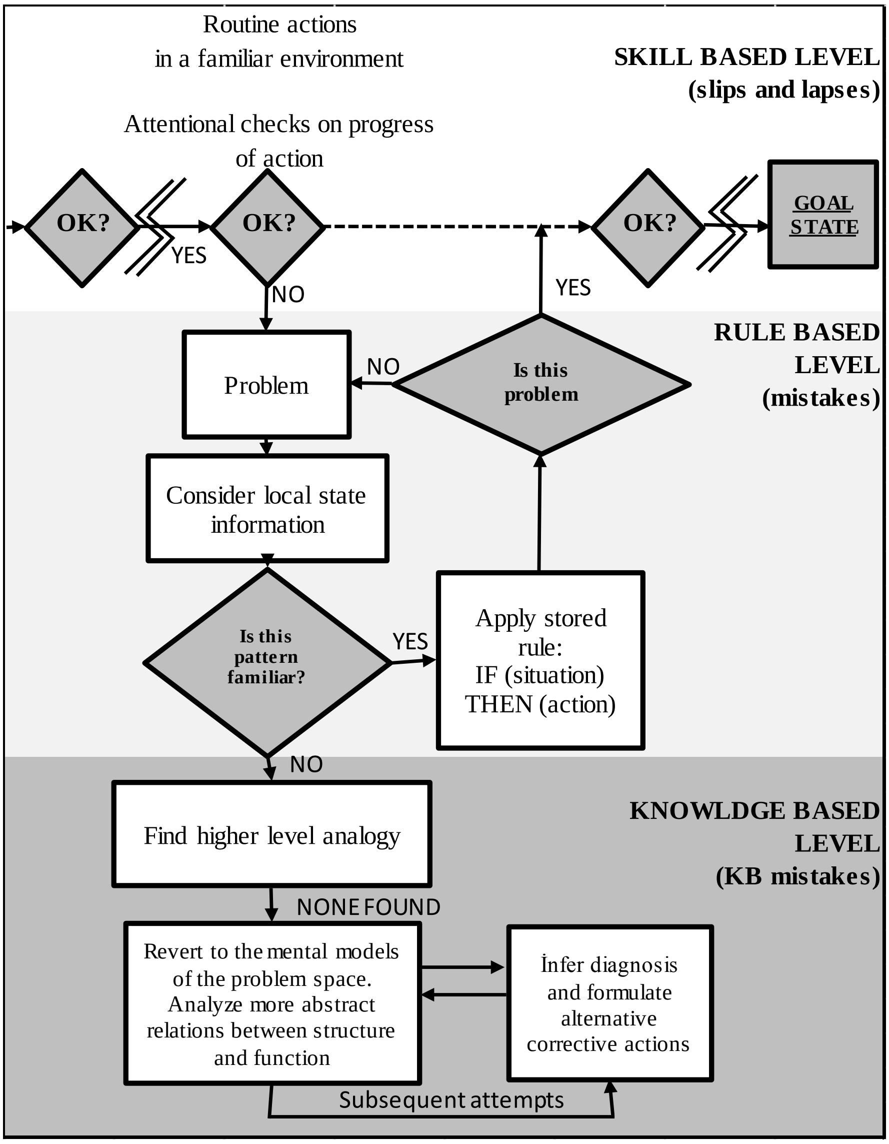

Figure 2.4 Dynamics of Generic Error Modeling System (GEMS) ([50] from Reason [52])

2.6.3 *Solutions for Human Error*

Suggesting solutions for different groups of human errors is only possible by good understanding of the above explained level passages and adopting a rather systematic approach.

Embrey (2005) [50] reports that recovery is quick and efficient in the skill-based mode since the operator will be aware of the consequence expected and will receive an immediate feedback in return for the slips and he emphasizes the significant role of feedback system. The feedback may be in the form of auditory and visual warnings and may remind the operator that a step is/is not completed [8]. In prevention of skill-based errors, these aids would be more beneficial than a training to be given. For attention failures (slips), memory failures (lapses) and technical skill-based errors; job tasks and responsibilities need to be improved, workspace should be enhanced, practices and procedures, rule books, instructions and all written job aids as well as tools and equipment ought to be bettered [23].

In rule-based decision errors, didactic trainings are expected to be functional. Furthermore, checklists may be used as procedural aids. In case of the decision errors that promote risk taking behaviors, especially in high-risk industries for the operators to correctly identify the hazards, the training should include scenario based parts with visuals of potential hazards. Besides, the warnings reminding the potential hazards should be used [8].

Standard operating procedures (SOP) are reported to be helpful in recognition and reduction of errors of this sort. However, having these procedures would not suffice, the culture to follow them should be implemented as well [46].

In the case of either rule-based or knowledge-based mistakes, operators have a tendency to be led by their expectation rather than feedback which may make them feedback blind. The mindset syndrome prevents them to see the disconfirming evidence [50].

Added to procedural and training improvements, personal protective equipment should be in accordance with the needs of the operators and be available where needed [23].

Pair work is of importance in all types of errors since the errors are unintentional and not easily recognized by the one who commits them. Hence, team trainings should be included in the training program [46].

Certainly the attitude of the management is of crucial importance. Management's approach to prioritize safety over mission would encourage the workers to stay in the safe zone while making decisions [46].

CHAPTER 3

DEVELOPMENT AND APPLICATION OF SAFETY CULTURE, SAFETY LEADERSHIP AND UNSAFE ACT QUESTIONNAIRES

The relationship between safety culture and workplace safety, direct and indirect effects of safety culture on accidents and injuries are focus of attention in occupational safety area. Safety culture questionnaires, one to one interviews with the workers and related observation check lists have been used in work organizations in order to reduce the accidents. Yet, the safety culture dimensions are sector specific. Therefore, the first objective of this research study is to apply a safety culture frame work generated specifically for mineral processing and coal preparation plants. With this aspect current study is the first one investigating the safety culture in preparation plants with a sector specific tool developed.

The second objective is to investigate the effect of leadership factor on safety. A previously applied questionnaire [42] was translated and applied to understand the effect of leadership perception on work place safety and unsafe act.

The final objective was to generate an unsafe act scale based on Reason's algorithm [52] applicable in preparation plants in the light of information collected through literature survey as well as the views of experts. The effects of safety culture and leadership factors on unsafe acts and accidents were investigated deeply by correlation, regression and mediation analysis.

3.1. STUDY 1: Developing the Safety Culture Questionnaire

3.1.1 *Aim of the study*

The aim of the present study is to develop an instrument to measure the safety culture maturity level in preparation plants. As mentioned before a workplace may be at one of the safety culture levels (pathological, reactive, bureaucratic, proactive or generative) in different dimensions of health and safety. The health and safety dimensions differ from sector to sector or even from workplace to workplace. Hence, the health and safety dimensions for coal preparation were determined by literature review and by the contribution of health and safety professionals working in the field. Semi structured interview questions were developed according to the pre-study preparations. The tool developed was formerly used in another study (dissertation [55] for expertise in Health and Safety of Ministry of Labor and Social Security). The data regarding safety culture in coal preparation plants was partly taken from that study.

3.1.2 *Determination of the Dimensions and Interview Questions*

For the dimensions and related questions to be comprehensive; the health and safety legislation in Turkey, the causes of the accidents in the coal preparation plants of Turkish Hard Coal Enterprises between the years 2003-2013 were overviewed. Moreover the questions were based on the occupational standard published by Board of Occupational Competency, Turkey and the studies in literature [35] [36] [40]. The dimensions were checked by 6 mining engineers (2 engineers working at preparation plants, 2 official inspectors, 2 occupational safety experts) and were revised based on their feedbacks. The dimensions determined in this study are given in Table 3.1. The questions were open ended questions type.

The first dimension “Continuous improvement of occupational health and safety” covered issues such as commitment of the management to health and safety and carrying the health and safety policy into action by defining and monitoring health and safety goals.

Priority of occupational health and safety dimension was to comprehend the safety production relationship.

Table 3.1 Occupational health and safety dimensions

Dimension Code	Dimension title
SC 1	Continuous improvement of occupational health and safety
SC 2	Priority of occupational health and safety
SC 3	Occupational accidents /near misses and reporting such incidents
SC 4	Investigation of occupational accidents /near misses
SC 5	Learning from occupational accidents /near misses
SC 6	Communication and feedback systems
SC 7	Occupational health and safety trainings
SC 8	Occupational safety in regular tasks
SC 9	Equipment and general state of the plant
SC 10	Preparedness for emergency cases

The reporting systems and reporting culture was investigated at the third dimension. Here, the common means of reporting in the plants were questioned. In the literature this dimension was listed together with incident investigation. However, it is regarded as a separate dimension in this study since the replies were expected to be rather detailed.

In the fourth dimension when/ by whom and how the incidents and near misses were investigated were questioned.

Learning from occupational accidents/near misses dimension questioned how the knowledge gathered from the investigation was shared. The means employed to learn organizationally from the events experienced were to be found out.

The dimension “Communication and feedback systems” was about how open the communication on health and safety was. The possibility of sharing complaints and advices with the supervisor, whether or not the feedbacks were given was also investigated in this dimension.

In dimension about the trainings the physical conditions of the training rooms, the instructors, visual quality of the trainings and the quality of the training content were questioned.

In the “Occupational safety in regular tasks dimension” the degree of interlacing of daily tasks and safety was investigated. The precautions taken in daily works were questioned.

The ninth dimension about the physical state of the plant and the equipment was added although such a dimension did not appear in the literature. The preparation plants ranged significantly in terms of physical conditions. Even the decision on whether or not the working conditions were bettered is based on the dominant atmosphere at the workplace and the approach of the management to such enhancements.

The final dimension was reserved to emergency preparedness in order to understand the approach and strategy towards the plants to rarely occurring health and safety occasions.
The questions that the interview based on were prepared so as to hold space for the interviewee to give detailed information but not to convey the answers. The list of the questions is provided in Table 3.2.

Table 3.2 Safety Culture Matrix-Interview questions

OHS dimension	Questions
1. Continuous improvement of occupational health and safety	• How are the investments on OHS planned and applied? • What is the major aim of OHS investments? • What is the managements' approach to provide a safe and healthy workplace to workers? • Which ways are followed to improve the current status of OHS in the workplace? • What are the goals related to OHS? • How are the activities related to OHS monitored? • How do the employees and the employer contribute to the improvement of OHS?
2. Priority of occupational health and safety	• How seriously are the OHS rules taken? • Who are expected to behave in compliance with these rules? • How are the OHS tasks carried out (risk assessment, exposure measurements)? • Who is responsible for OHS? • Do workers know the hazards of their job? • How does the employees and employer react in case of an instant apparent danger?
3. Occupational accidents /near misses and reporting such incidents	• What are the common hazards? What kind of near misses and accidents may take place? • What is the approach against OHS incidents? • How do the employees behave when an incident takes place? • To whom is the incident reported and how?
4. Investigation of occupational accidents /near misses	• What takes place when an accident, incident, near miss or unsafe act or behavior is reported? • Who investigates the work accidents and near misses? • Who are referred for information upon an accident or near miss? • When and how is the investigation carried out? • Why are the incidents recorded?

Table 3.2 Safety Culture Matrix-Interview questions (cont.)

5. Learning from occupational accidents /near misses	• How the OHS are related incidences evaluated? • How is the information obtained from the investigation put to use? • How is the information gathered from the investigation shared with the employees? • With whom this information is shared?
6. Communication and feedback systems	• How do the employees share their complaints and suggestions related to OHS? • In what different ways does the communication take place between the management and employees?
7. Occupational health and safety trainings	• How is the quality of the trainings? • Who delivers the trainings? • In what physical conditions are the trainings carried out? • How often are the trainings repeated? • How do the employees benefit from the trainings? • How important are the OHS trainings? • Who participates in these trainings?
8. Occupational safety in regular tasks	• How is the workload? • Is there time pressure? • What are the OHS precautions related to your tasks? • How seriously are these precautions taken?
9. Equipment and general state of the plant	• In what condition is the equipment in the plant with regards to OHS? • How well-organized is the plant? • How is the ground (wet, muddy, dry)? • How are the stairs in the plant?
10. Preparedness for emergency cases	• How are the emergency teams determined? • How do the emergency teams work in case of emergency? • How do the employees and teams prepare for states of emergency? • How are the emergency drills carried out?

3.1.3 *Interviews*

Semi-structured interviews were carried out based on afore given question list and the interview tools prepared. Interviews took about 60-90 minutes and were carried out one to one in the offices provided by the employers. The information about the plants where interviews took place is given in Table 3.3.

Table 3.3 Coal preparation plants in which interviews took place

Plant	Number of workers	Capacity (Mton/year)	Washing method
Plant A	35	1.5	Heavy medium drum, flotation, heavy medium cyclone
Plant B	40	1.1	Jig
Plant C	22	2	Heavy medium bath, heavy medium cyclone
Plant D	21	2	Heavy medium bath, heavy medium cyclone

It was of importance to hold a trustworthy space during the interviews. The questions were addressed neutrally and leading or accusing manners were avoided. The participants were allowed to reply the open-ended questions with his/her own words based on their experiences in the current preparation plant as well as in the other plants, the trainings that they got, the experiences they got to hear from their colleagues. The interviewee was allowed take his/her time to think about the question. As the interviewee finished answering a question; the interviewer summarized the answer by reciting the interviewee's words. Technical terms were avoided on purpose and sectorial jargon was adopted instead. The interviewer filled up the previously formed matrix in accordance with the reply of the participant.

3.1.4 *Coal Preparation Safety Culture Matrix (CP-SFM)*

The answers of the employees to the interview questions were noted down on an empty CP-SFM sheet (columns: of safety culture levels, rows: safety culture dimensions). Saturation was reached and further interviews were not carried out when the answers reached a point of consensus where differences between the answers ceased. The answers from the different participants were compiled without changing the gist and the wording.

The filled matrix was checked by one occupational safety expert mining engineer from the industry, one OHS labor inspector from ministry and one mining engineer academician from university. In these checks they were asked to consider the following:

1: Does each the sentence in the cells fit in the related safety culture level?
2: Does each the sentence in the cells fit in the related safety culture dimension?
3: Are the explanations too broad or too detailed?

The matrix gained the final form after the revisions of the experts from the industry, ministry and university.

3.1.5 *The Safety Culture Questionnaire*

The questionnaire (Appendix A) was prepared by summarizing the coal preparation safety culture matrix. The columns from the matrix i.e. the safety maturity levels were presented as choices. The participants were asked to choose the choice closest to the plant he/she worked.

3.1.6 *Participants*

3.1.6.1. *The interview Participants*

The CP-SFM questionnaire was developed by in-depth semi-structured interviews (60-90 minutes) with 20 workers. Table 3.4 provides a list of occupations of the interviewees. Multistage sampling that pays regard to homogenous distribution to different occupational groups was employed in selection of interviewees. The participants were selected based on occupation variety.

Table 3.4. Information about the safety culture interviewees

Number of interviewees	The job in the plant	Tasks
1	OHS Professional	Tasks related to occupational health and safety
1	Mining Engineer	Production planning
3	Supervisor	Supervising tasks and workers
3	Repair Maintenance	Repair equipment and carry on periodic maintenance tasks
3	Electricity Technician	Electricity system controls and repair
3	Sampling	Taking samples from the band conveyor, pulp or from sampling points
6	Other	Check the equipment functioning, unclogging (bunker, silo, feeder, crusher, screen), cleaning and clearing material around (band conveyor and screen), carrying material and tools in the plant

3.1.6.2. *Safety Culture Questionnaire Participants*

Since the safety culture is specific to the work process, safety culture questionnaire was applied to a subgroup of the sample, namely to coal preparation plants only. The large coal preparation plants employ more than 50 workers however most of the plants are rather small and employ about 20 workers. There are 20-25 coal preparation plants in Turkey. Hence the population size was assumed as 900 considering the number of coal preparation plants and average number of workers per plant.

The z score for 99% confidence interval is 1.96. Based on the assumption of homogeneity of the population in terms of unsafe acts p and q values were assumed equal (.5). For an error margin of 10% (d=.1) the sample size was calculated as:

$$n = \frac{N*P*Q*Z_{0.05}^2}{(N-1)*d^2} \qquad \text{Equation 3.1}$$

$$= \frac{900*0.5*0.5*\ 1.96_{0.05}^2}{(900-1)*0.1^2} = 96.17 \cong 97$$

Where

N: population size

n: sample size

p: percentage picking a choice

q: percentage not picking a choice (1-p)

Z: Z score value for the confidence interval of 99%.

d: error margin

98 participants filled up the safety culture questionnaire. Related descriptive statistics is given in Table 3.5.

Table 3.5. Descriptive statistics for age, experience and weekly working hours for coal preparation plants

		Experience (years)	Weekly Working Hours	Age (years)
N	Valid	74	90	94
	Missing	24	8	4
Mean		9.64	48.46	37.58
Std. Deviation		8.473	3.317	7.708
Minimum		1	40	20
Maximum		34	58	54

The mean working experience was around 9.64 years with a maximum of 34 years (Figure 3.1). More than 40% of the workers had a working experience in the plant less than 5 years. Around 12% of the workers had a working experience more than 25 years.

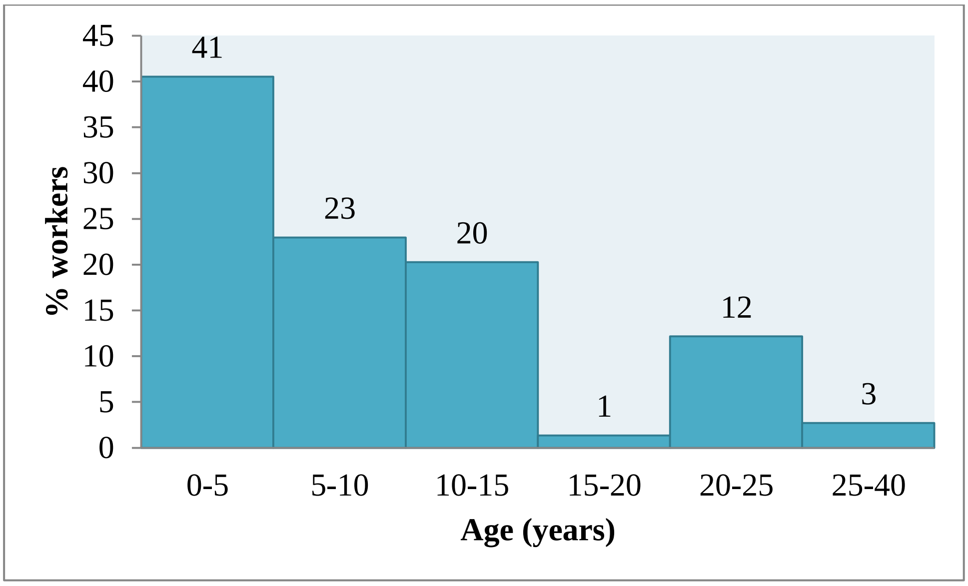

Figure 3.1 Distribution of experience of the participants of safety culture study

The working hours in these coal preparation plants changed between 40 to 58 hours. The average weekly working hours (>48) exceeded the normal weekly working hours (45) declared in Turkish Labor Law [56]. Thus overtime working could be considered to be quite common in coal preparation plants. Moreover, according to the legislations daily working hours cannot be more than 11 hours under no circumstances. Among the coal preparation plants in this study only 10.6% of the plants did not work overtime with working time <46 hours while 18% of the plants worked more than 10 hours overtime (Figure 3.2.).

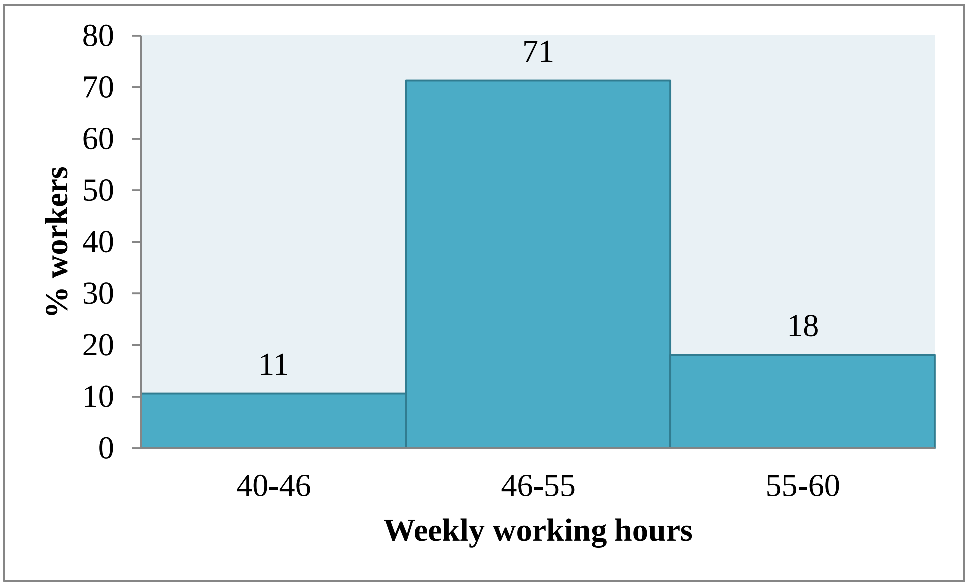

Figure 3.2 Distribution of weekly working hours of the participants of safety culture study

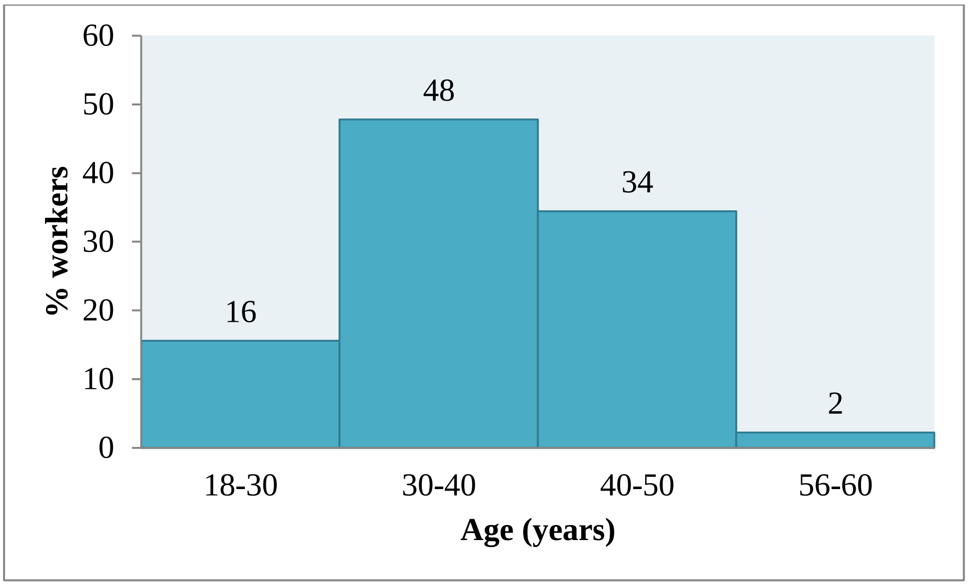

Figure 3.3 Age distribution of the participants of safety culture study

The ages of the participants ranged between 20 and 54 with a mean age of 37.58 years. The work force in the coal preparation plants was young since more than 60% of the workers were younger than 40 years old. Less than 3% of the workers were older than 50 years old (Figure 3.3).

3.2. STUDY 2: Safety Leadership Questionnaire

3.2.1 *Aim of the Study*

The aim of investigating the safety leadership is to develop an understanding about the effect of leadership perception of the workers on the unsafe acts and work accidents.

3.2.2 *The questionnaire*

The leadership scale was translated from a previous study conducted in Taiwanese University [44]. The scale was comprised of 19 questions where the worker evaluated his first order superior in terms of safety leadership behaviors.

3.2.3 *Participants*

Cluster sampling which is commonly used when the target population is spread across geography was employed to determine the number of participants to fill the questionnaire since the plants under investigation is located in different areas of Turkey. According to this sampling method equation 3.1 was used to calculate the sample size.

According to 2013 data of Social Security Institution there are totally 140,000 workers working in coal, metal, industrial mines and mine quarries. Assuming a 5% mineral processing and coal preparation worker ratio to total number of workers, the population size would be around 5600.

The z score for 99% confidence interval is 1.96. Based on the assumption of homogeneity of the population in terms of unsafe acts p and q values were assumed equal (.5). For an error margin of 9% (d=0.09) the sample size was calculated as:

$$n = \frac{N*P*Q*Z_{0.05}^{2}}{(N-1)*d^{2}} \qquad \text{.......................................Equation 3.2}$$

$$= \frac{5600*0.5*0.5*\ 1.96_{0.05}^{2}}{(5600-1)*0.09^{2}} = 118.59 \cong 119$$

Where

N: population size

n: sample size

p: percentage picking a choice

q: percentage not picking a choice (1-p)

Z: Z score value for the confidence interval of 99%.

d: error margin

Although 119 participants would be sufficient with an error margin of 9%, 241 workers attended the questionnaire from 7 different mineral processing and coal preparation plants which reduced the error margin down to 6.3%.

The questionnaire was applied to 241 workers from 7 different mineral processing and coal preparation plants. Table 3.6 displays the distribution of participants to these plants. Table 3.7 gives the descriptive statistics for the demographic information collected.

The average processing plant experience of the participants was 9 years with a maximum of 34 years. More than 45% of the workers had a working experience in the plant less than 5 years. Around 10% of the workers had a working experience more than 25 years. 27% of the workers older than 50 years old had less than 5 years' experience in the plant (Figure 3.4).

Table 3.6. Distribution of participant from the plants

Mineral Processing / Coal Preparation Plant	Type of plant	Number of participants
A	Coal Preparation Plant	40
B	Iron Ore Processing Plant	43
C	Copper Ore Processing plant	19
D	Coal Preparation Plant	19
E	Coal Preparation Plant	43
F	Coal Preparation Plant	30
G	Copper Ore Processing Plant	40

Table 3.7 Descriptive statistics for age, experience and weekly working hours

		Experience (years)	Weekly working hours	Ages (years)
N	Valid	198	231	232
	Missing	43	10	9
Mean		9.19	49.06	36.63
Std. Deviation		8.166	5.076	8.121
Minimum		1	40	20
Maximum		34	68	59

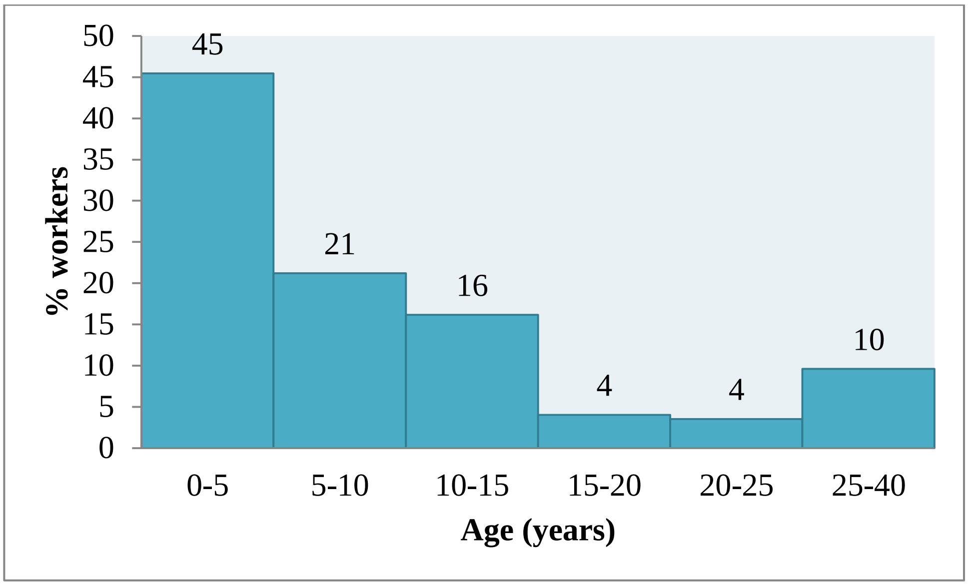

Figure 3.4 Experience distribution of the participants of safety leadership and unsafe act study

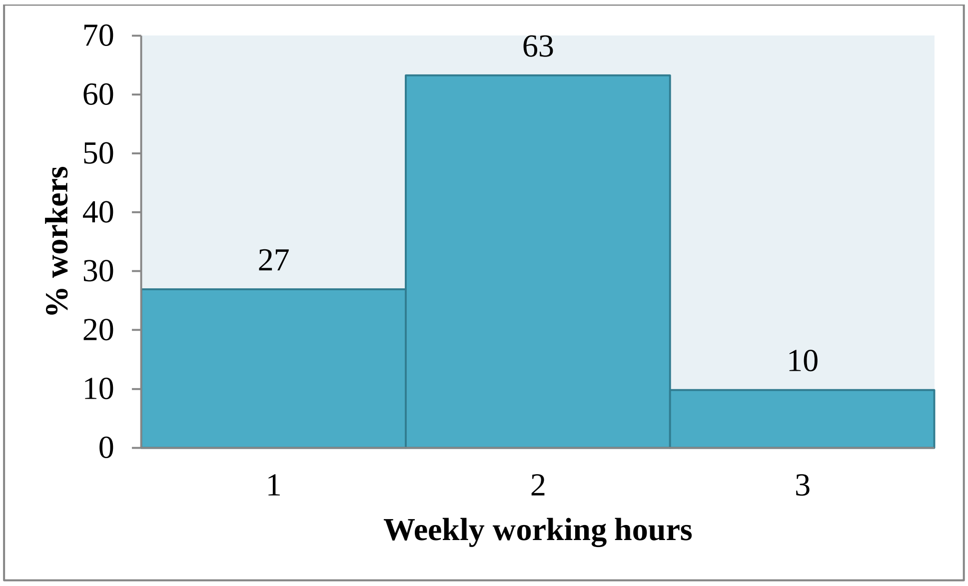

Figure 3.5 Distribution of weekly working hours of participants of safety leadership and unsafe act study

The working hours of the participants changed between 40 to 68 hours for the participants from different preparation plants. The ages of the participants ranged between 20 and 59 with a mean age of 36.63 years. According to Turkish Labor Law [56] working hours beyond 45 hours are regarded as overtime working. Thus it was seen that overtime working was quite common in the mineral processing plants and coal preparation plants under investigation. This was because the plants should operate 7 days a week and workers have 1 day off during the week. Distribution of weekly working hours is provided in Figure 3.5. Moreover, daily working hours cannot be more than 11 hours under no circumstances. Among the plants in this study only 25% of the plants did not work overtime while 10% of the plants worked more than 10 hours.

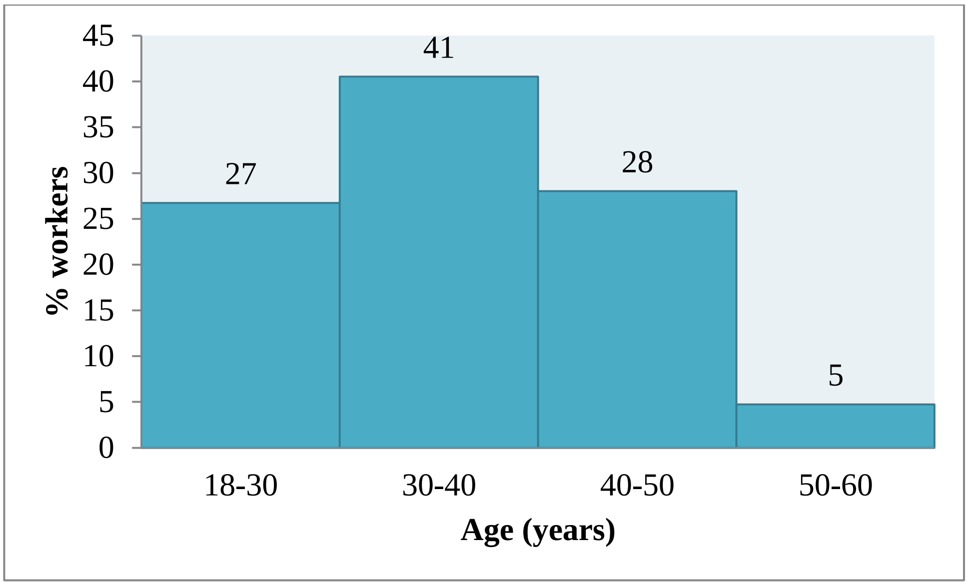

Figure 3.6 Age distributions of the participants of safety leadership and unsafe act study

The work force in the preparation plants was young since more than 60% of the workers were younger than 40 years old. Less than 5% of the workers were older than 50 years old (Figure 3.6).

3.3. STUDY 3: Developing the Unsafe Acts Questionnaire

3.3.1 *Aim of the study*

The aim of the present study is to develop an instrument for measuring the frequency of the unsafe acts including slip, lapse, rule based, knowledge based errors and violations exhibited in mineral processing and coal preparation plants.

As mentioned previously slips (skill based) are attentional errors. Such errors may take place in all tasks and even during walking from a place to place in the plant. Lapses (skill based) are rather related to memory and are critical especially in tasks related to checking the operability of equipment. Rule based errors and knowledge based errors are rather significant in tasks related to repair and maintenance. Violations, either routine or exceptional, occur when the worker intentionally breaks a rule. In order to develop this tool accident records were investigated, task lists for mineral processing plants were overviewed and opinions of the professionals in the field were recieved.

3.3.1.1. *Occupational Accidents in Mineral Processing/ Coal Preparation Plants*

In order to determine the unsafe acts to investigate in the questionnaires, 49 accidents in 3 coal preparation plants from 2003 to 2013 have been evaluated. The data was used to determine the dangerous acts with regard to the tasks carried out. Moreover, the dangerous equipment, units around which the accidents were most common was evaluated while determining the questions. Besides, 6 fatal accidents that took place in coal preparation plants in the U.S.A between 2007 and 2013 were investigated for unsafe acts causing the accidents.

3.3.1.2. *Accidents in Mineral Processing Plants in Turkey*

For the questionnaire not to miss any act related to the occupational accidents in a mineral processing plant the accident data of 3 coal preparation plants for the years 2003-2013 were evaluated. Moreover, the fatal accidents that took place in plants were reviewed. In the three plants, the accident data of which was evaluated, six of the 49 accidents took place around or related to band conveyors (121 work day losses) (Table 3.8.)

There were 16 accidents of to slip/trip/fall occurring while walking on the wet or rough ground (155 work day losses). Eleven accidents took place due to equipment, 3 of which were around the screen (89 workday losses apart from the fatal accident) and one of these 3 was a fatal accident. (Table 3.9). The fatal accident took place when the worker was caught between the band conveyor and the side rubbers of the screen. Thus, in the questionnaire preparation stage there should be emphasis on these areas.

Furthermore, most of the accidents took place during repair and maintenance tasks and while walking in the plant whereas the highest workday loss per accident is seen in equipment check task. Hence, more detailed questions regarding these tasks were included in the questionnaire. The accident data classified according to tasks is given in Table 3.10

Moreover, task lists provided in literature were referred to so that every act of the workers in the plant was covered. Such lists are provided in the literature survey section.

Table 3.8. Accident distribution for the case study in accordance with the area or unit

Unit/ Area	Number of accidents	Workday losses	Workday loss per accident
Band conveyor	6	121	20
Screen	3 (1 fatal)	7505	2502
Equipment	8	84	8
Floor	16	155	9
Silo	3	7	2
Other	7	53	8

Table 3.9. Accident distribution for the case study in accordance with the task

Work/task	Number of accidents	Workday losses	Workday loss per accident
Maintenance	14 (1 fatal)	7661	426
Equipment check	2	81	41
Unclogging	5	22	4
Walking	11	47	5
Cleaning and clearing	3	26	13
Carrying tools and materials	2	18	9
Hand picking	1	15	15
Other	5	55	11

3.3.2 *The Questionnaire*

The questionnaire (Appendix A) was prepared by attributing related unsafe acts to the tasks in the light of the accident data and task lists reviewed. There were 64 questions to be replied in accordance with the frequency of attaining the cited act by the workers. Among these questions 22 were to catch violations (red in Appendix A), 9 were for slips (green in Appendix A), 13 were for lapses (blue in APPENDIX A), 18 were for mistakes (decision errors) (purple in Appendix A). Two of the questions in the questionnaire (question 61 and 63) were positive questions.

The questionnaire was reviewed by six professionals (two OHS inspectors of ministry, one OHS Manager, one occupational safety expert, one associate professor in mining engineering department, one mining engineer working in a mineral processing plant). The questionnaire was reshaped in accordance with the suggestions of the professionals.

3.3.3 *Participants*

The number of participants was determined via the same method as the participants of Safety Leadership Questionnaire as 119 (Equation 3.1). The descriptive statistics are also the same as study 2 since these two questionnaires were applied to the same participants.

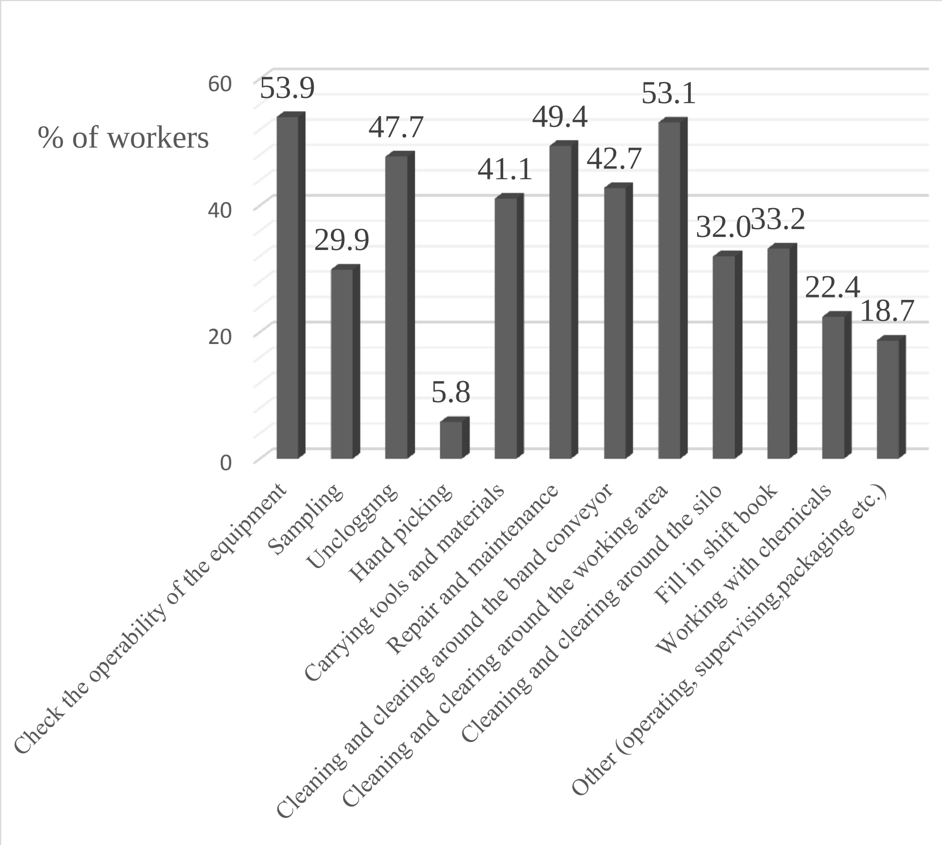

Figure 3.7 Distribution of workers amongst tasks in the plant

The preparation plant workers conduct more than one task in the plant. The tasks that were most commonly carried out were checking the operability of the equipment (53.9% of the workers), cleaning and clearing the working area (53.1% of the workers), repair and maintenance (49.4% of the workers), unclogging (47.7 of the workers), cleaning and clearing around the band conveyor (42.7% of the workers) and carrying tools and materials in the plant (41.1% of the workers). The distribution of workers to different tasks is provided in Figure 3.7.

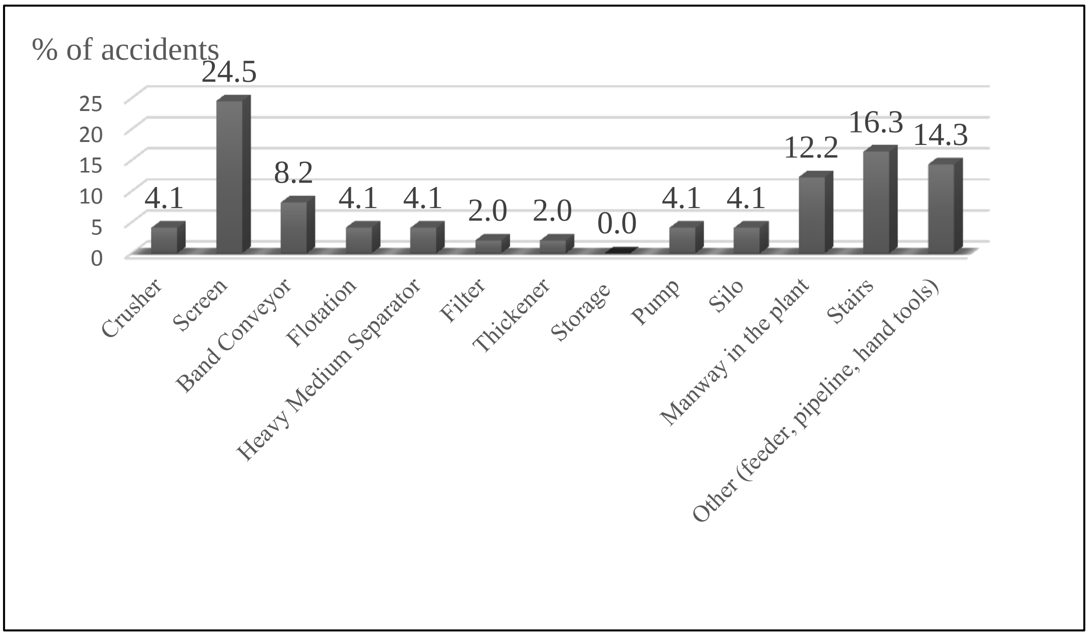

Figure 3.8 Distribution of accidents amongst equipment and areas

24.5% of the accidents experienced in the last 3 years and reported within the questionnaire were around the screen. The accidents caused by the man ways and stairs summed up to 28.5%. The complete accident distribution in plants is given in Figure 3.8.

3.4. STUDY 4: Analysis of the Data

3.4.1 *Factor Analysis*

Factor analysis is a statistical method used to collect the high number of items describing variability under lower number of unobserved factors. In a way, factor analysis provides the underlying bondage between different items in terms of variation. Commonly principal axis factoring (PAF) is applied as the extraction method. PAF seeks the least number of factors that can account for the common variance of a set of variables. The factor loadings display the degree of commonality between the items under investigation. Loading displays the proportion of the variance in that item explained by the factor. The items having a loading less than .35 were not included in the factor sets. The eigenvalues employed in factoring show the explanatory importance of the factors with respect to the variables.

In this study, principal axis factoring with promax rotation was employed to seek the commonalities among the questionnaire items in safety leadership and unsafe act questionnaires. It was possible to analyze the relationships between different variables by classifying the high number of factors (19 items for leadership, 62 items for unsafe acts) in accordance with common backgrounds. Moreover, the factor analysis was used to reveal the structure underlying these items.

3.4.2 *Correlation Analysis*

Correlation displays the mutual relationship between two or more variables. Positive correlation means that the variables increase and decrease together. Negative correlation shows that an increase in one variable causes a decrease in the other and vice versa. The correlation coefficient gives the strength of the relationship and changes between 0 and 1.

In this study, bivariate correlations between the demographic information, safety culture, safety leadership, unsafe actand accidents were carried out. The correlataions significant at the 0.01 level (2-tailed) and the 0.05 level (2-tailed) were evaluated.

3.4.3 *Regression Analysis*

The regression studies the effect of independent variables (denoted as x or IV) or explanatory variables on the dependent variable (y or DV). The beta coefficient explains the degree of association on the dependent variable upon a unit change in the independent variable. Step wise linear regression applied in an automatic sequence of tests was employed in the current study.

Hierarchical multiple regression was employed where "enter" method was used to test the improvement of variables' contribution to the model. In all these tests demographic information (age, experience, weekly working hours) was entered in the model initially as is typical in hierarchical multiple regression analysis and the contributions of the secondary independent variables were analyzed.

Firstly the effects of safety culture, safety leadership and unsafe acts on accidents were studied. Below given is a list of the dependent and independent variables entered in these models (Table 3.10):

Table 3.10. Hierarchical multiple regression sets on the effect of safety culture, safety leadership and unsafe acts on workplace accidents

#	DV	IV (first step)	IV (second step)
1	Total Number of accidents in the last 3 years	Demographic information (age, experience, weekly working hours)	Safety Culture Dimensions
2			Safety Leadership factors
3			Unsafe act factors

Secondly the effects of safety culture and safety leadership on each unsafe act were studied by hierarchical multiple regression where the demographic information was added initially to the model. Below, the DV, IV distribution of these models is provided (Table 3.11):

Table 3.11. Hierarchical multiple regression sets on the effect of safety culture and safety leadership on unsafe acts

#	DV	IV (first step)	IV (second step)
1	Equipment and material related perception error	Demographic information (age, experience, weekly working hours)	Safety Culture Dimensions
2	Personal protective equipment relevant routine violation		
3	Absentmindedness and lapses in some tasks		
4	Exceptional violations due to production over safety approach		
5	Slips causing tripping jamming and falling		
6	Equipment and material related perception error	Demographic information (age, experience, weekly working hours)	Safety Leadership factors
7	Personal protective equipment relevant routine violation		
8	Absentmindedness and lapses in some tasks		
9	Exceptional violations due to production over safety approach		
10	Slips causing tripping jamming and falling		

3.4.4 *Mediation Analysis*

Mediation analysis allows the differentiation of direct and indirect effect of an independent variable (IV) on a dependent variable (DV). The coefficient “c” gives the total effect of “IV” on “V”. The total effect is composed of the direct effect (c’) of “IV” on “DV” and indirect effect (a+b). Indirect effect is realized through a mediator (M) (Figure 3.9). When c> c’ the occurrence of an indirect effect over mediator is proved.

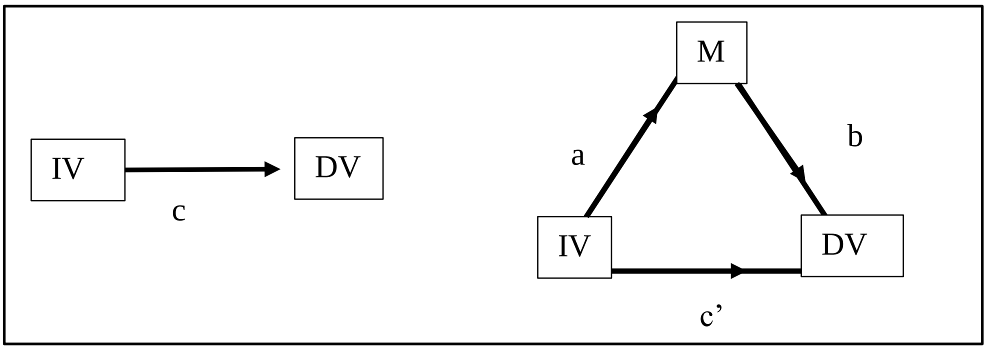

Figure 3.9 Basics of mediation

In this study the indirect effects of safety culture and safety leadership on the number of accidents experienced in the last three years over unsafe acts were analyzed where dependent, independent variable and mediator distributions were as given below (Table 3.12):

Table 3.12. Mediation sets on the indirect effect of safety culture and safety leadership on unsafe acts

<table>
<tr><th>#</th><th>DV</th><th>IV</th><th>M</th></tr>
<tr><td>1</td><td rowspan="10">Total Number of accidents</td><td>SC1:Continuous improvement of occupational health and safety</td><td rowspan="10">Equipment and material related perception errors

PPE relevant routine violation

Absentmindedness and lapses in some tasks

Exceptional violations due to production over safety approach

Slips causing tripping jamming and falling</td></tr>
<tr><td>2</td><td>SC2: Priority of occupational health and safety</td></tr>
<tr><td>3</td><td>SC3: Occupational accidents /near misses and reporting such incidents</td></tr>
<tr><td>4</td><td>SC4: Investigation of occupational accidents /near misses</td></tr>
<tr><td>5</td><td>SC5: Learning from occupational accidents /near misses</td></tr>
<tr><td>6</td><td>SC6: Communication and feedback systems</td></tr>
<tr><td>7</td><td>SC7: Occupational health and safety trainings</td></tr>
<tr><td>8</td><td>SC8: Occupational safety in regular tasks</td></tr>
<tr><td>9</td><td>SC9: Equipment and general state of the plant</td></tr>
<tr><td>10</td><td>SC10: Preparedness for emergency cases</td></tr>
</table>

CHAPTER 4

RESULTS

4.1. FACTOR ANALYSIS

The factor analysis was applied to safety leadership and unsafe act data to evaluate the underlying structure.

4.1.1 *Safety Leadership*

The data obtained on the safety leadership behaviors of the supervisors (foreman, engineer, occupational safety expert) in mineral processing/coal preparation plants with 19 items having 5– Likert type scale was evaluated. The item scores differed from 1 (completely disagree) to 5 (completely agree) while “u.d” term in the scores represented “not applicable” and was coded missing in the analysis. PAF analysis, with promax rotation was employed to see underlying factor structure by virtue of assumption that the items would correlate with each other. The data were analyzed by Barlett’s sphericity test and Kaiser-Meyer-Olkin (KMO) measures to evaluate the factorability. The analyses were factorable since KMO measure of sampling adequacy (.942) was greater than .5 and Bartlett sphericity test was significant ($p < .05$) (Table 4.1)

Table 4.1 Results of KMO and Bartlett’s sphericity test for unsafe act study

KMO Measure of Sampling Adequacy.		.942
Bartlett's Test of Sphericity	Approx. Chi-Square	4782.941
	Df	171
	Sig.	.000

The item scores differed from 1 (always) to 5 (never) while (u.d) represented “not applicable” and was coded missing in the analysis.

According to the principal axis factor analysis 2 components (Table 4.2) were found and these two factors explained 71.14% of the total variance (Table 4.3). The scree plot (Figure 4.1) revealed a clear bend after 2 factors. The first factor had including most of the items had a 56.64% share of this total variance and the second explained the rest 14.49%. The first factor including 15 items could be named as “Leadership coaching and caring” while the second one included the rest of items about “Leadership awareness and effort” (Table 4.4) (the contents of the items are provided in Appendix A).

Table 4.2. Pattern matrix for the five factors of leadership items

Item code	Factor	
	1	2
l7	.898	
l9	.883	
l3	.869	
l10	.866	
l15	.864	
l5	.862	
l18	.856	
l17	.853	
l2	.852	
l16	.842	
l1	.805	
l13	.791	
l8	.784	
l6	.780	
l14	.657	
l19		
l11		.994
l12		.992
l4		.991

Extraction Method: Principal Axis Factoring.

a. 2 factors extracted, 3 iterations required.

Table 4.3 Total variance explained by the two leadership factors

Factor	Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
	Total	% of Variance	Cumulative %	Total
1	10.762	56.643	56.643	10.701
2	2.755	14.499	71.142	3.543
Extraction Method: Principal Axis Factoring.				
a. When factors are correlated, sums of squared loadings cannot be added to obtain a total variance.				

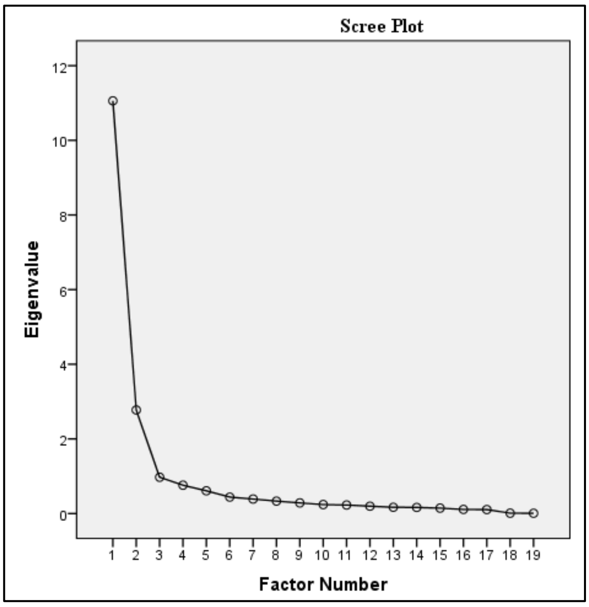

Figure 4.1 Scree plot of factor analysis of leadership items

Table 4.4 Distribution of items within 2 leadership factors

Factor 1	Factor 2
Leadership coaching and caring	Leadership awareness and effort
l7 l9 l3 l10 l15 l5 l18 l17 l2 l16 l1 l13 l8 l6 l14	l11 l12 l4

4.1.2 *Unsafe Act*

In order to determine the underlying factor structure of unsafe acts (slips, lapse, mistake, violation), principal axis factor analysis (promax rotation) was applied on the unsafe act questionnaire data from 241 participants. Missing values were excluded list wise. The data included 64 items (assigned the codes a1 to a64 where a represented "answer") having 5 point Likert type scale. The item scores differed from 1 (always) to 5 (never) while "u.d" term in the scores represented "not applicable" and was coded missing in the analysis.

The data was analyzed by Barlett's sphericity test and Kaiser-Meyer-Olkin measures to understand the factorability. The data was found factorable since KMO measure of sampling adequacy (.697) was greater than .5 and Bartlett sphericity test was significant ($p < .05$) (Table.4.5). According to the principal axis factor analysis 5 components with eigenvalue of greater than 1.0 were found. The factor loadings for these components can be seen in Table 4.6 (item contents are provided in Appendix A). These five factors explained 52.588% of the total variance (Table 4.7) (rest of the total variance table is provided in the Appendix B). The scree plot (Figure 4.2) revealed a clear bend after 5 factors.

Table.4.5 Results of KMO and Bartlett's test for unsafe act study

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.697
Bartlett's Test of Sphericity	Approx. Chi-Square	5900.489
	Df	1891
	Sig.	.000

Table 4.6. Pattern matrix for the five factors of unsafe acts

	Factor						Factor				
	1	2	3	4	5		1	2	3	4	5
a28	.838	-.205	.164		-.134	a21		.359		.210	
a30	.738		-.246	.180	.105	a1	-.199	.355		.216	
a26	.703	-.116	.125			a60			.909	-.174	
a29	.660					a56	-.118	.201	.830	-.146	
a54	.591		.243	-.257	.107	a59		.185	.830	-.190	
a31	.589		-.324	.217	.223	a44			.779		
a23	.578	.336			-.152	a45			.640	.136	.119
a33	.576	.194				a40		.101	.606	.112	
a24	.529	.226				a52	.284	-.224	.565	.251	
a27	.505		.266			a58	-.152	.112	.541	.271	
a53	.474		.291		-.101	a46		.168	.513		.278

Table 4.6. Pattern matrix for the five factors of unsafe acts (cont.)

	Factor						Factor				
	1	2	3	4	5		1	2	3	4	5
a19	.459	.309		.111		a41	.248		.454	.137	
a35	.441			.371		a55	.386	-.105	.428		
a57	.429			-.131	.372	a64	.309		.404	-.174	
a25	.422		.379			a61	.291		.389	.191	-.142
a22	.368	.144	.303	-.162	.192	a37				.871	-.113
a5	.297	.720	.107	-.278		a39	.183		-.307	.862	.120
a6		.695				a17		.158		.591	
a9	-.152	.694	.165			a34	.409	.226	-.353	.494	
a14		.681	.209			a36	.316		.224	.490	-.235
a15	-.144	.646		.245		a32	.379	-.161	.201	.441	
a3	.190	.627		-.189		a42	.278	-.146	.145	.439	
a10	.193	.592		.127		a43	.335	-.193	.185	.384	.185
a16	-.249	.585	.118	.388		a18	.273	.228		.361	
a13	.139	.577	.191	-.131		a38				.215	
a7	.123	.570		-.105	-.144	a48			-.104		.933
a20	.276	.554	-.156		.126	a47			.126		.797
a11	-.142	.527	.125	.318		a49					.740
a2	.123	.521		-.173	.107	a51			.123		.722
a4	.494	.510	-.235	-.162		a50				.195	.705
a8		.501			.103	Extraction Method: Principal Axis Factoring.					
a12	-.189	.484	.251	.355		Rotation Method: Promax with Kaiser Normalization.					
						a. Rotation converged in 12 iterations.					

Table 4.7 Total variance explained by the five unsafe act factors

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	20.802	33.551	33.551	20.351	32.824	32.824
2	4.553	7.344	40.895	4.160	6.710	39.534
3	3.906	6.299	47.194	3.478	5.610	45.144
4	2.875	4.638	51.832	2.455	3.960	49.104
5	2.602	4.196	56.028	2.160	3.484	**52.588**
Extraction Method: Principal Axis Factoring.						

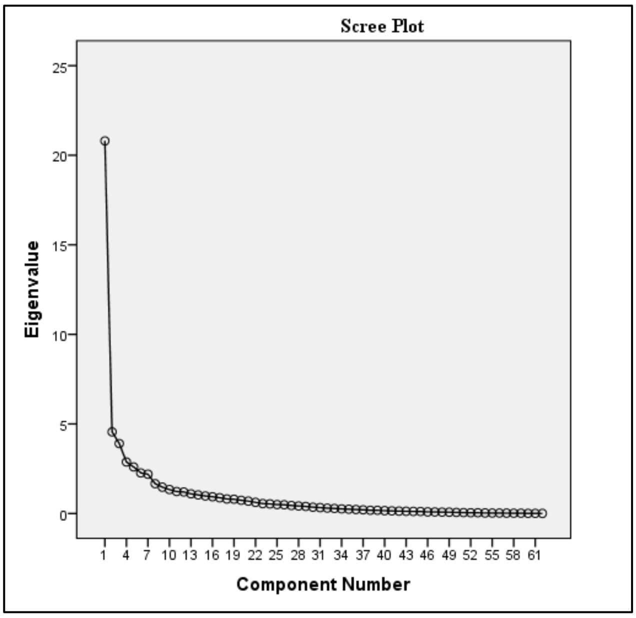

Figure 4.2 Scree plot of factor analysis of unsafe acts

4.1.2.1. *Factors explaining unsafe acts*

Each item was included under the factor on which it had the highest loading in the pattern matrix. According to the pattern matrix the factors were classified as in Table 4.6. In differentiation of the items into the factors, items a1, a12, a21, a22, a55, a61 and a64 were not included since the loadings were quite close for more than one factor. The other factors excluded had eigenvalues less than 0.35.

The distribution of the total variance explained by these five factors was 32.82, 6.71, 5.61, 3.96, 3.48 (Table 4.7) from factor 1 to factor 5. By interpreting the related items, the first factor could be named as “Underestimating the risk in non-routine tasks”; the second one could be thought as representing “PPE relevant routine violations”. The third factor covered “Absentmindedness and lapses in some tasks”. Factor 4 included “Exceptional violations due to production over safety approach” while the last factor could be governed by “Slips causing tripping, jamming and falling”. Table 4.8 gives the list of the names attributed to the factors. The factors were named in accordance with the common concept that the items shared.

Table 4.8 Distribution of items within 5 unsafe act factors

Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Equipment and material related perceptual errors	PPE relevant routine violations	Absentmindedness and lapses in some tasks	Exceptional violations due to production over safety approach	Slips causing tripping, jamming and falling
a19, a23, a24, a25, a26, a27, a28, a29, a30, a31, a33, a35, a53, a54, a57,	a10, a11, a13, a14, a15, a16, a2, a20, a3, a4, a5, a6, a7, a8, a9,	a40, a41, a44, a45, a46, a52, a56, a58, a59, a60,	a17, a32, a34, a36, a37, a39, a42	a47, a48, a49, a50 a51,

4.2. RELIABILITY

In order to test the reliability of the questionnaire applied Cronbach alpha reliability analysis was applied on IBM SPSS Statistics v22. The Cronbach alpha (α) for the safety culture scale with 10 items was .932 which proved that the scale generated is highly reliable (Table 4.9).

Table 4.9. Reliability analysis for safety culture

Safety Culture	
α	N of Items
.932	10

For safety leadership act scale the Cronbach alfa values for the two factors were greater than .8 which proved the scale to be highly reliable (Table 4.10).

Table 4.10. Reliability Analysis for 2 leadership factors

FACTOR 1 Leadership coaching and caring		FACTOR 2 Leadership awareness and effort	
α	N of Items	α	N of Items
.964	16	.996	3

The Cronbach Alfa values turned greater than .8 implying that the questionnaire prepared was highly reliable for each factor of unsafe acts (Table 4.11).

Table 4.11. Reliability analysis for 5 unsafe act factors

FACTOR 1 Underestimating the risk in non-routine tasks		FACTOR 2 PPE relevant routine violations		FACTOR 3 Absentmindedness and lapses in some tasks		FACTOR 4 Exceptional violations due to production over safety approach		FACTOR 5 Slips causing tripping, jamming and falling	
α	N of Items	α	N of Items	α	N of Items	α	N of Items	α	N of Items
.904	15	.888	15	.915	10	.835	7	.904	5

4.3. CORRELATIONS

At this section bivariate correlations between different variables were analyzed. The correlation of the demographic information with unsafe act, safety culture and safety leadership were evaluated. Besides the correlations between total number of accidents, unsafe act, safety culture and safety leadership were analyzed.

4.3.1 *Correlations with demographic information*

The correlation analyses between safety culture levels and age, experience, weekly working hours showed that the safety culture levels did not correlate with the age and experience of the participants. On the other hand, safety culture scores for all ten safety culture dimensions correlated negatively with the weekly working hours (Table 4.12).

When the demographic information collected was analyzed for correlation with the leadership factors it was seen that leadership coaching and caring scores correlated positively with the experience of the workers (.169) while correlating negatively with weekly working hours (-.186). On the other hand no association was determined for leadership awareness and effort and demographic data (Table 4.12).

When the bivariate correlation analysis between experience, age, weekly working hours and unsafe acts were carried out; it was seen that there were not any significant correlation between the unsafe acts “PPE relevant routine violations”, “Exceptional violations due to production over safety approach” and experience, age, weekly working hours .

Nevertheless, there was significant correlation between the “weekly working hours” and “Equipment and material related perceptual errors” (.172) and “Absentmindedness and lapses in some tasks” (.190).

4.3.2 *Correlations between unsafe acts and safety leadership and safety culture*

When the bivariate correlations between the leadership factors and unsafe acts were analyzed it was seen that the violation type acts -either routine (-.165) or exceptional (-.208) were correlated with leadership coaching and caring. The perception and memory errors; slips and lapses were not correlated with the leadership (Table 4.12) .

When the correlation of unsafe acts and safety culture core dimensions were evaluated, it was seen that the second safety culture dimension on priority of safety over production (-.295) and fourth dimension on investigation of accidents and near misses (-.220) correlated negatively with equipment and material related perceptual errors.

PPE relevant routine violations positively (.216) correlated with the continuous improvement dimension which is an indicator of management commitment to safety.

Absentmindedness and forgetting some tasks while checking the operability of equipment and electric works negatively correlated with the safety culture dimensions regarding “reporting the incidents” (-.222) and “communication and feedback” (-.251).
There was negative correlation between the exceptional violations and investigation of occupational incidents (-.220).

Interestingly, the slip type errors correlated with the safety culture in seven different dimensions. Slip type errors correlated negatively with continuous improvement of occupational health and safety (-.212), priority of occupational health and safety (-.341), occupational accidents /near misses and reporting such incidents (-.245), investigation of occupational accidents /near misses (-.327), communication and feedback systems (-.293), equipment and general state of the plant (-.230) and preparedness for emergency cases (-.269).

None of the unsafe acts correlated with the safety culture levels related with dimension on training (Table 4.12).

4.3.3 *Correlations between the accidents and unsafe acts, safety culture and safety leadership*

The only unsafe act group associated with the occupational accidents in the last 3 years was slips causing tripping, jamming and falling (.232). The other unsafe act factors did not correlate with the accidents that took place in the last 3 years

The number of accidents that occurred in the last three years in the preparation plants associated significantly with leadership coaching and caring (-.205) and leadership awareness and effort (-.213) in negative direction (Table 4.12).

4.3.4 *Correlations between Safety Culture Dimensions and Leadership Factors*

Correlation analysis between the leadership acts and safety culture dimensions showed that some of the safety culture dimensions correlated significantly with the leadership coaching and caring and leadership awareness and effort. The dimension on continuous improvement of occupational health and safety did not have any significant association with the leadership factors. The safety culture dimensions about priority of health and safety over production, investigation of and learning from incidents and emergency preparedness had no significant association with leadership factors. These dimensions included the activities beyond the expectations of participants from the safety leaders (Table 4.12). Apart from these dimensions, the correlations showed that the safety leader had a critical role in development of the safety culture. For the leadership coaching and caring the correlation was in positive direction for the safety culture dimensions occupational accidents /near misses and reporting such incidents (.237), Communication and feedback systems (.301), occupational health and safety trainings (.248), occupational health and safety in daily tasks (.290) and equipment and general state of the plant (.311). Leadership awareness and effort was positively correlated with the dimensions concerning occupational accidents /near misses and reporting such incidents (.211), Communication and feedback systems (.274), occupational health and safety in daily tasks (.256) and equipment and general state of the plant (.309).

Table 4.12 Correlation Analysisfor udemographic information, safety culture, safety leadership and unsafe acts

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1.Experience (years)	Pearson Corr.	1																			
	Sig. (2-tailed)																				
	N	198																			
2.Weekly working hours	Pearson Corr.	-.229**	1																		
	Sig. (2-tailed)	.001																			
	N	195	236																		
3.Age (years)	Pearson Correlation	.605**	-.087	1																	
	Sig. (2-tailed)	0	.193																		
	N	195	228	232																	
4. SC1:Continuous improvement of occupational health and safety	Pearson Corr.	.067	-.354**	.1	1																
	Sig. (2-tailed)	.568	0	.349																	
	N	74	94	90	98																
5. SC2: Priority of occupational health and safety	Pearson Corr.	.042	-.261*	.148	.545**	1															
	Sig. (2-tailed)	.723	.011	.163	0																
	N	74	94	90	98	98															
6.SC3: Occupational accidents /near misses and reporting such incidents	Pearson Corr.	.025	-.286**	.178	.692**	.680**	1														
	Sig. (2-tailed)	.832	.005	.093	0	0															
	N	74	94	90	98	98	98														
7.SC4: Investigation of occupational accidents /near misses	Pearson Corr.	.101	-.269**	.2	.499**	.740**	.623**	1													
	Sig. (2-tailed)	.393	.009	.058	0	0	0														
	N	74	94	90	98	98	98	98													
8.SC5: Learning from occupational accidents /near misses	Pearson Corr.	-.036	-.269**	.093	.486**	.771**	.604**	.745**	1												
	Sig. (2-tailed)	.762	.009	.384	0	0	0	0													
	N	74	94	90	98	98	98	98	98												
9.SC6: Communication and feedback systems	Pearson Corr.	.138	-.278**	.136	.641**	.664**	.703**	.586**	.630**	1											
	Sig. (2-tailed)	.241	.007	.202	0	0	0	0	0												
	N	74	94	90	98	98	98	98	98	98											
1.SC7: Occupational health and safety trainings	Pearson Corr.	.073	-.313**	.134	.555**	.646**	.634**	.597**	.608**	.710**	1										
	Sig. (2-tailed)	.534	.002	.208	0	0	0	0	0	0											
	N	74	94	90	98	98	98	98	98	98	98										
11.SC8: Occupational safety in regular tasks	Pearson Corr.	-.01	-.319**	-.018	.614**	.689**	.700**	.634**	.649**	.692**	.707**	1									
	Sig. (2-tailed)	.936	.002	.865	0	0	0	0	0	0	0										
	N	74	94	90	98	98	98	98	98	98	98	98									
12.SC9: Equipment and general state of the plant	Pearson Corr.	-.005	-.381**	.064	.509**	.502**	.588**	.569**	.512**	.501**	.691**	.599**	1								
	Sig. (2-tailed)	.965	0	.546	0	0	0	0	0	0	0	0									
	N	74	94	90	98	98	98	98	98	98	98	98	98								
13.SC10: Preparedness for emergency cases	Pearson Corr.	.064	-.168	-.048	.311**	.419**	.362**	.491**	.377**	.433**	.488**	.336**	.469**	1							
	Sig. (2-tailed)	.587	.106	.652	.002	0	0	0	0	0	0	.001	0								
	N	74	94	90	98	98	98	98	98	98	98	98	98	98							
14.Leadership coaching and caring	Pearson Corr.	.169*	-.186**	-.028	.183	.17	.237*	.172	.155	.301**	.248*	.290**	.311**	.158	1						
	Sig. (2-tailed)	.02	.005	.683	.083	.107	.024	.104	.143	.004	.018	.005	.003	.134							
	N	190	224	220	91	91	91	91	91	91	91	91	91	91	228						
15.Leadership awareness and effort	Pearson Corr.	-.019	-.128	-.092	.151	.17	.211*	.183	.141	.274**	.199	.256*	.309**	.171	.249**	1					
	Sig. (2-tailed)	.798	.056	.174	.154	.109	.046	.085	.186	.009	.06	.015	.003	.108	0						
	N	189	222	218	90	90	90	90	90	90	90	90	90	90	226	226					
16.Equipment and material related perception errors	Pearson Corr.	-.085	.172**	-.125	-,067	-,295**	-,156	-,220*	-,128	-,169	-,124	-,059	-,179	-,072	-.084	-.067	1				
	Sig. (2-tailed)	.239	.009	.061	,523	,004	,136	,035	,222	,107	,239	,575	,087	,497	.206	.314					
	N	193	228	224	92	92	92	92	92	92	92	92	92	92	226	225	233				
17.PPE relevant routine violation	Pearson Corr.	-.064	.104	-.044	.216*	-.122	.132	-.089	-.046	.043	.026	.102	.007	-.002	-.165*	-.045	.558**	1			
	Sig. (2-tailed)	.377	.115	.506	.036	.24	.203	.393	.656	.681	.8	.325	.947	.986	.013	.499	0				
	N	195	233	229	95	95	95	95	95	95	95	95	95	95	228	226	233	238			
18.Absentmindedness and lapses in some tasks	Pearson Corr.	-.033	.102	-.06	-.115	-.199	-.222*	-.181	-.068	-.251*	-.089	-.191	-.171	-.096	-.123	-.048	.469**	.359**	1		
	Sig. (2-tailed)	.648	.126	.372	.27	.056	.032	.082	.517	.015	.397	.066	.102	.36	.064	.472	0	0			
	N	192	228	224	93	93	93	93	93	93	93	93	93	93	226	225	232	233	233		
19.Exceptional violations due to production over safety approach	Pearson Corr.	-.172*	.190**	-.114	.084	-.175	-.082	-.220*	-.062	-.148	-.014	.015	-.125	-.174	-.208**	-.085	.691**	.518**	.387**	1	
	Sig. (2-tailed)	.018	.004	.088	.427	.095	.439	.035	.554	.16	.896	.886	.235	.097	.002	.204	0	0	0		
	N	190	227	223	92	92	92	92	92	92	92	92	92	92	224	223	230	232	231	232	
2.Slips causing tripping jamming and falling	Pearson Corr.	.017	-.094	.035	-.212*	-.341**	-.245*	-.327**	-.163	-.293**	-.17	-.177	-.230*	-.269*	-.002	-.022	.313**	.175**	.423**	.232**	1
	Sig. (2-tailed)	.821	.169	.616	.049	.001	.022	.002	.132	.006	.116	.101	.032	.012	.981	.751	0	.009	0	.001	
	N	183	215	211	87	87	87	87	87	87	87	87	87	87	214	214	220	220	220	220	220
21. Number of accidents experienced in the last 3 years	Pearson Corr.	-.110	.217	.084	-.128	.079	-.172	.081	.105	-.022	.137	-.096	.044	.126	-.205	-.213	.146	.046	.068	.177	.034
	Sig. (2-tailed)	.177	.003	.262	.223	.452	.102	.443	.318	.833	.191	.363	.677	.231	.006	.005	.050	.530	.361	.017	.662
	N	152	183	179	92	92	92	92	92	92	92	92	92	92	176	175	181	186	182	181	169

** Correlation is significant at the .01 level (2-tailed).

* Correlation is significant at the .05 level (2-tailed).

SC1-SC10: Safety culture dimensions

4.4. REGRESSION

The relationships amongst demographic data, safety leadership, safety culture and the unsafe acts were investigated deeply by regression analyses. Hierarchical linear regression was employed and was applied with “enter” method where variables were added successively and tested for the improvement of contribution to the model. The demographic distribution data was introduced to the analysis formerly while unsafe accidents, safety leadership and safety culture were added secondly.

4.4.1 *Hierarchical Multiple Regression: Accident vs. Demographic Distribution and Safety Culture*

The relationship between the number of accidents in the last three years versus age, weekly working hours, experience in the field and safety culture dimensions was investigated by hierarchicalal multiple regression where safety culture dimensions were added to the model in the second step. No significant relationship between the safety culture dimensions and work accidents were encountered.

4.4.2 *Hierarchical Multiple Regression: Accident vs. Demographic Distribution and Leadership*

The relationship between the number of accidents in the last three years versus age, weekly working hours, experience and leadership factors was investigated by hierarchical multiple regression where leadership factors were added to the model in the second step.

The results showed that the age, work experience, weekly working hours and leadership awareness and effort contributed significantly to the accidents experienced (Table 4.13) (R^2 =.109, F (5, 135) = 3.292, p < .05). According to the model leadership awareness and effort had a decreasing effect on the work accidents while weekly working hours had an increasing effect. The other independent variables had quite low beta coefficients (**Hata! Başvuru kaynağı bulunamadı.**).

Table 4.13 ANOVA for accidents vs. demographic information and leadership factors regression

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	9.096	3	3.032	1.601	.192[b]
	Residual	259.372	137	1.893		
	Total	268.468	140			
2	Regression	29.174	5	5.835	3.292	.008[c]
	Residual	239.295	135	1.773		
	Total	268.468	140			

Table 4.14 Regression Coefficients for accidents vs. demographic information and leadership factors regression

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
(Constant)	B	Std. Error		-.719	.474
Age	-1.430	1.990	.063	.621	.535
Work experience	.010	.017	-.065	-.643	.521
Weekly working hours	-.011	.017	.116	1.404	.163
Leadership coaching and caring	.066	.267	.061	.246	.806
Leadership awareness and effort	-.331	.242	-.339	-1.370	.173
a. Dependent Variable: Total number of accidents					

4.4.3 *Hierarchical Multiple Regression: Accident vs. Demographic Distribution, Unsafe Acts*

No significant relation could be detected by hierarchical multiple regression of work accidents in the last 3 years with age and experience. Only effective factor was found to be weekly working hours and all unsafe acts were removed from the significant model.

4.4.4 *Hierarchical Multiple Regression: Unsafe Acts vs. Demographic Background Safety Culture*

4.4.4.1. *Equipment and material related perceptual errors*

Hierarchical multiple regression applied to evaluate the effect of safety culture dimensions on the equipment and material related perception errors displayed no significant relationship (p>.05)

4.4.4.2. *PPE relevant routine violations*

When the safety culture dimensions were investigated for their effect on PPE related routine violations by hierarchical multiple regression it was found that there was no significant relationship between routine violations and safety culture dimensions (p>.05).

4.4.4.3. *Absentmindedness and lapses in some tasks*

When the relationship between the safety culture dimensions and absentmindedness and lapses in some tasks was analyzed by hierarchical multiple linear regression it was revealed that the safety culture had significant influence on these acts (R^2 =.340. F (13. 51) = 2.022. p < .05) (Table 4.15).

Table 4.15 ANOVA for Absentmindedness and lapses in some tasks vs. safety culture regression

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	.214	3	.071	.165	.920[b]
	Residual	26.446	61	.434		
	Total	26.661	64			
2	Regression	9.069	13	.698	2.022	.038[c]
	Residual	17.592	51	.345		
	Total	26.661	64			
a. Dependent Variable: Absentmindedness and lapses in some tasks						
b. Predictors: (Constant). Age. Work experience,Weekly working hours						
c. Predictors: (Constant). Age. Work experience, Weekly working hours, SC10, SC1, SC4, SC6, SC9, SC5, SC8, SC3, SC7, SC2						

Both long working hours (β=- .155, $p < .05$) and age (β=- .110, $p < .05$) showed decreasing effect on lapse type acts. Long working hours showed decreasing effect on lapse type acts opposite to the expectation of positive association in lapse type errors due to fatigue (Table 4.16). However, the experience (β=.158, $p < .05$) contributed to memory related errors.

Among the safety culture dimensions; communication and feedback systems (SC6) seemed to have negative association on these type errors (β=-.567, $p < .05$) more effectively compared to all the other dimensions and demographic factors. Safety communication includes how freely workers share their complaints and suggestions related to safe work.

The safety culture dimensions related to continuous improvement and learning from the accidents had positive association with the lapse type errors. Same is valid for the dimensions about training and emergency preparedness.

Table 4.16. Regression coefficients for Absentmindedness and lapses in some tasks vs. safety culture regression

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	3.437	1.623		2.118	.039
Age	-.009	.013	-.110	-.712	.480
Work experience	.012	.011	.158	1.033	.307
Weekly working hours	-.028	.027	-.155	-1.040	.303
SC 1. Continuous improvement of occupational health and safety	.146	.090	.301	1.614	.113
SC 2. Priority of occupational health and safety	-.115	.157	-.185	-.734	.466
SC 3. Occupational accidents /near misses and reporting such incidents	-.061	.122	-.107	-.496	.622
SC 4. Investigation of occupational accidents /near misses	-.103	.115	-.194	-.902	.371
SC 5. Learning from occupational accidents /near misses	.234	.138	.380	1.692	.097

Table 4.16. Regression coefficients for Absentmindedness and lapses in some tasks vs. safety culture regression (cont.)

SC 6. Communication and feedback systems	-.370	.128	-.567	-2.888	.006
SC 7. Occupational health and safety trainings	.146	.137	.232	1.066	.292
SC 8. Occupational safety in regular tasks	-.129	.125	-.220	-1.032	.307
SC 9. Equipment and general state of the plant	-.135	.126	-.214	-1.073	.288
SC 10. Preparedness for emergency cases	.037	.099	.054	.377	.707
a. Dependent Variable: Absentmindedness and lapses in some tasks					

4.4.4.4. *Exceptional violations due to production over safety approach*

Hierarchical multiple regression applied to evaluate the effect of safety culture dimensions on the exceptional violations showed significant relationship (*R2* =.399, *F* (13. 50) = 2.557, p < .05) (Table 4.17). Such violations based on production over safety approach increased with younger age and longer working hours. Strongest effect was displayed by continuous improvement (SC1. β=.569, p < .05) and communication (SC6. β=- .506, p < .05) dimension of safety culture (Table 4.18)

Slips causing tripping, jamming and falling

Hierarchical multiple regression applied to evaluate the effect of safety culture dimensions on the equipment and material related perception errors displayed no significant relationship (p>.05).

Table 4.18Table 4.17 ANOVA for exceptional violations due to production over safety approach vs. safety culture regression

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	1.463	3	.488	.417	.741[b]
	Residual	70.145	60	1.169		
	Total	71.608	63			
2	Regression	28.593	13	2.199	2.557	.009[c]
	Residual	43.015	50	.860		
	Total	71.608	63			
a. Dependent Variable: Exceptional violations due to production over safety approach						
b. Predictors: (Constant). Work experience,Weekly working hours						
c. Predictors: (Constant). Work experience, Weekly working hours SC10, SC1, SC4, SC6, SC9, SC5, SC8, SC3, SC7, SC2						

4.4.4.1. *Slips causing tripping, jamming and falling*

Hierarchical multiple regression applied to evaluate the effect of safety culture dimensions on the equipment and material related perception errors displayed no significant relationship (p>.05).

Table 4.18 Regression coefficients for exceptional violations due to production over safety approach vs. safety culture regression

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	.472	2.567		.184	.855
Age	.018	.020	.134	.908	.368
Work experience	-.012	.018	-.098	-.667	.508
Weekly working hours	.036	.043	.122	.849	.400
SC 1. Continuous improvement of occupational health and safety	.451	.143	.569	3.155	.003
SC 2. Priority of occupational health and safety	-.400	.248	-.392	-1.613	.113
SC 3. Occupational accidents /near misses and reporting such incidents	-.025	.193	-.027	-.129	.898
SC 4. Investigation of occupational accidents /near misses	-.315	.181	-.360	-1.739	.088
SC 5. Learning from occupational accidents /near misses	.370	.219	.366	1.688	.098

Table 4.18 Regression coefficients for exceptional violations due to production over safety approach vs. safety culture regression (cont)

SC 6. Communication and feedback systems	-.542	.202	-.506	-2.679	.010
SC 7. Occupational health and safety trainings	.287	.223	.272	1.287	.204
SC 8. Occupational safety in regular tasks	.261	.199	.269	1.314	.195
SC 9. Equipment and general state of the plant	-.330	.200	-.319	-1.648	.106
SC 10. Preparedness for emergency cases	-.101	.157	-.088	-.646	.521
a. Dependent Variable: Exceptional violations due to production over safety approach					

4.4.5 *Hierarchical Multiple Regression: Unsafe Acts vs. Demographic Background and Leadership*

In order to explain the variance in different unsafe act classes the effect of demographic structure and leadership factors were investigated by hierarchicalal multiple regression.

4.4.5.1. *Equipment and material related perceptual errors*

The hierarchicalal multiple regression was applied with dependent variable "Equipment and material related perceptual errors" and age, weekly working hour, experience in the first level and leadership coaching and caring and leadership

awareness and effort at the second level. The model was significant for both leadership factors (*R2* =. 060, *F* (5. 177) = 2.272, p < .05) (
Table 4.19).

Equipment and material related perceptual errors were negatively associated with leadership awareness and effort (β=-.044, p < .05), leadership coaching and caring (β= -.087, p < .05) and age (β=- .095, p < .05) of the participant (Table 4.20) while experience had increasing effect ((β=.043, p < .05).

Table 4.19 ANOVA for equipment and material related perceptual errors vs. demographic information and leadership factors regression

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	5.899	3	1.966	3.137	.027[b]
	Residual	112.211	179	.627		
	Total	118.109	182			
2	Regression	7.124	5	1.425	2.272	.049[c]
	Residual	110.985	177	.627		
	Total	118.109	182			
a. Dependent Variable: Equipment and material related perception errors						
b. Predictors: (Constant). Age. Work experience, Weekly working hours						
c. Predictors: (Constant Age. Work experience, Weekly working hours, Leadership awareness and effort. Leadership coaching and caring						

4.4.5.2. ***PPE relevant routine violations***

The routine violations showed no significant relation with the leadership factors (p>.05).

4.4.5.3. *Absentmindedness and lapses in some tasks*

No significant relationship was encountered between the absentmindedness and lapses in some tasks and leadership factors ($p>.05$).

Table 4.20 Regression coefficients for equipment and material related perceptual errors vs. demographic information and leadership factors regression

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	-1.188	1.078		-1.101	.272
Age	-.009	.009	-.095	-1.001	.318
Work experience	.004	.009	.043	.452	.652
Weekly working hours	.052	.020	.190	2.555	.011
Leadership coaching and caring	-.057	.051	-.087	-1.115	.266
Leadership awareness and effort	-.005	.008	-.044	-.577	.565
a. Dependent Variable: Equipment and material related perception errors					

4.4.5.4. *Exceptional violations due to production over safety approach*

Exceptional violations were associated with age, weekly working hours; leadership coaching and caring and leadership awareness and effort at the second level to certain extent ($R2$ =.104. F (5. 175) = 4.077, p < .05) (Table 4.21). Leadership coaching and caring contributed dominantly to the decrease in such acts (β=-.240) compared to the other independent variables. Exceptional violation increased only with weekly working hours (β=-.143, p < .05) (Table 4.22)

Table 4.21 ANOVA for Exceptional violations due to production over safety approach vs. demographic information and leadership factors regression

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7.407	3	2.469	2.950	.034[b]
	Residual	148.125	177	.837		
	Total	155.532	180			
2	Regression	16.227	5	3.245	4.077	.002[c]
	Residual	139.305	175	.796		
	Total	155.532	180			
a. Dependent Variable: Exceptional violations due to production over safety approach						
b. Predictors: (Constant). Weekly working hours. Experience. Age						
c. Predictors: (Constant). Weekly working hours. Experience. Age. Leadership awareness and effort. Leadership coaching and caring						

4.4.5.1. *Slips causing tripping, jamming and falling*

A statistically significant model could not be developed to explain slip errors in relation to demographic information and the leadership factors (p >.05).

Table 4.22 Regression coefficients for Exceptional violations due to production over safety approach vs. demographic information and leadership factors regression

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	-.144	1.216		-.118	.906
Age	-.006	.011	-.056	-.603	.548
Work experience	-.003	.011	-.029	-.308	.758
Weekly working hours	.045	.023	.143	1.955	.052
Leadership coaching and caring	-.181	.058	-.240	-3.128	.002
Leadership awareness and effort	-.004	.010	-.031	-.425	.671
a. Dependent Variable: Exceptional violations due to production over safety approach					

4.5. THE MEDIATING ROLE OF UNSAFE ACTS IN THE RELATIONSHIP BETWEEN SAFETY CULTURE, SAFETY LEADERSHIP AND ACCIDENTS

Mediation analysis was carried out to investigate the direct and indirect interactions between current study variables. For this analysis, the indirect macro improved by Andrew Hayes was employed.

4.5.1 *Safety Culture – Unsafe Acts – Accidents*

The relationship between each safety culture dimensions and unsafe acts with the accidents experienced at work were explored (Figure 4.3). Then the workplace accidents were evaluated based on leadership and unsafe acts. The direct effects of safety culture and leadership factors together with the indirect effects through unsafe acts on accidents were analyzed (p>.05 for all dimensions).

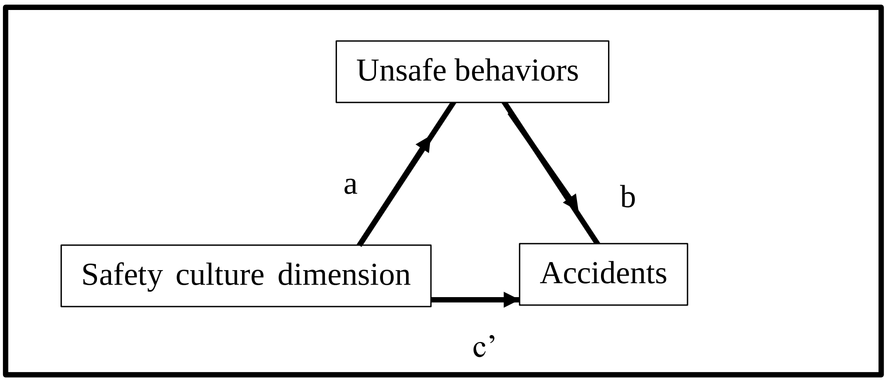

Figure 4.3 Mediation scheme for safety culture – unsafe acts – accidents (where a+b is the indirect effect safety culture on accidents while c’ stands for the direct effect)

None of the safety culture dimensions gave significant results for any group of the unsafe acts to impact the accidents through acts.

4.5.2 *Leadership – Unsafe Acts – Accidents*

When the number of accidents experienced were examined by leadership through unsafe act, the relationship was not significant for most of the unsafe act classes. However, leadership coaching and caring had an effect on accidents over the unsafe act grouped as exceptional violations due to production over safety approach (R^2= .064, F(2. 170)= 5.84. p< .5). The direct effect of leadership coaching and caring on accidents (-.199) was less than the total effect (c=-.230, p < .05). Hence it was concluded that leadership coaching and caring described the variance in accidents indirectly through exceptional violation acts (a=-.129. b=.229, p < .05) (Figure 4.4).

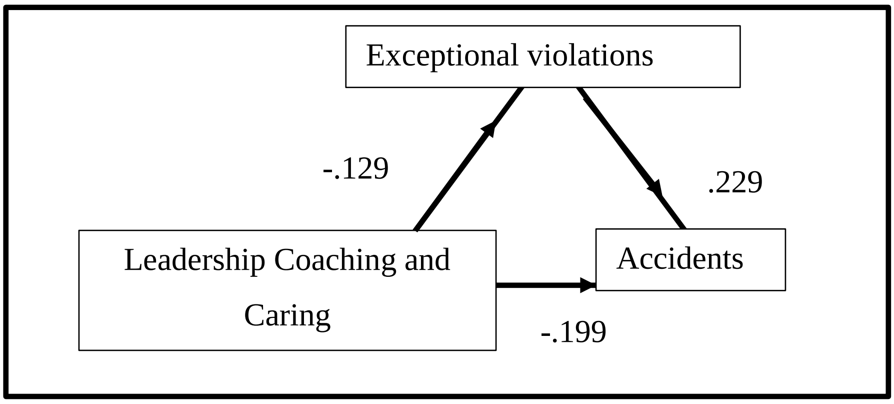

Figure 4.4 Mediation scheme for safety culture – unsafe acts – accidents

CHAPTER 5

DISCUSSION

5.1. Correlation Analysis

In correlation analysis overtime working was found to positively correlate with the accidents experienced and slips causing tripping, jamming and falling which showed that long working hours resulted in momentary inattentiveness and failure to see obstacles on the man way or on a part of an equipment. Workload and stress that can be associated with overtime working are known to interfere with knowledge based responses [50]. The errors rooting from long working hours can be attributed to fatigue associated with long hours of work. As mentioned by Wang et al. (2011) [57] increased working hours reduces the rest time between shifts and build up accumulative fatigue especially for the workers in night and morning shifts. In compliance with the current study, Wang et al. (2011) [57] mentions that fatigue may threaten coal workers' mental and physical health and cause serious accidents in coal mines. The shifts and overtime working should be planned considering the fatigue factor as suggested in literature [58]:

- Morning Shift start: 05.00-08.00 am end 02.00-06.00pm
- Evening Shift start: 02.00-06.00 pm end 10.00pm-02.00 am
- Night Shift start: 10.00pm-02.00 am 05.00-08.00am end

Moreover fatigue scales might be applied to the workers especially before critical tasks carried out during overtime working. Indeed, the fatigue risk index provided by Health and Safety Executive [59]. Besides, there was significant correlation between the “weekly working hours” and “equipment and material related perceptual errors” and “absentmindedness and lapses in some tasks” which showed that working overtime had a negative effect on the safety with the tasks related to the memory and perception.

When the correlations of leadership with different factors were analyzed, the positive correlation between leadership coaching and caring and the experience of the participants was interpreted as that experienced workers might have internalized some of the safety applications and were to appreciate them when they saw them applied by the safety leader. Leadership coaching and caring correlated with violation type unsafe acts. The important role of the safety leader at this point might be to plan the tasks in such a way that workers would not routinely ignore the safety rules to shortcut some of the safety procedures. Such violations take place when the sanctions are rarely applied. Thus consistent application of sanctions to delinquencies would reduce routine violations. The exceptional violations are considered to occur when a serious damage would be done on the production. Here the attitude of the leader towards safety over production concept had a determining role. Moreover, continuous supervision by the safety leader is expected to have a decreasing effect on violations. According to Fleming’s (2007) [36] field research, in the work places with the highest safety scores the safety field work was carried out weekly while this period was as long as 3 months in the mines with the lowest safety score. Hence it is essential that the safety leader show up frequently in the field and display that no respite would be given to violations of any type. The safety culture dimensions that were found not to correlate with leadership included the activities beyond the expectations of participants from the safety leaders.

The correlations of the safety culture dimensions with the unsafe acts showed that all the dimensions other that the one related to learning from accidents correlated with the factors under investigation in some way. The negative correlation between most of the safety culture dimensions and slip type errors implied that participants would be more attentive to what they perceive in a working environment where safety goes hand in hand with production. Furthermore, the depth of investigation after an accident or a near miss forces the participants to commute less perceptual errors.

The dimension of safety culture that covers the investments made by the management correlated positively with PPE related routine violations. It is probable that the participants would avoid using PPE since the employer would be investigating and investing on better technology in production for continuous improvement. Using PPE is the final step in health and safety controls. There are elimination, substitution, isolation and engineering and administrative controls ahead. A preparation plant that is being improved continuously would adopt these measures a priory and hence workers might have overconfidence in the precautions and commit PPE related violations.

Especially as the safety culture level increased towards the proactive and generative states accident and incident reporting and safety communication dimensions, the lapse type errors would decrease. Lapse errors could be easily dealt with by employing technical prevention measures such as memory aids and better machine human interfaces. Increased reporting and better communication approach would provide opportunity to employ the necessary technical measures by making use of the incident reports provided by the workers which in turn would reduce lapses.

The deep investigation carried out upon an incident would negatively correlate with the exceptional violations committed for the sake of the production. It could be inferred from the correlation of exceptional violations with the safety culture levels that workers would not expect a sanction for the violation they commit in favor of the production when the incidents were not investigated deeply. Certainly strict application of a sound investigation procedure and not compromising the sanctions even though the violations are in favor of production would help change this approach.

Some of the safety culture dimensions did not correlate with unsafe acts. One of them was the dimension on occupational health and safety trainings. This showed that the ideas of the participants on the trainings did not cover subject of safe act. Hence it might be helpful to include "safe act" as separate topic in the training schedule. Moreover, applied trainings on safe act might be carried out so that what is learned would be effective on the acts of workers. Same was valid for the safety culture dimension about learning from the accidents, occupational safety in regular tasks and emergency preparedness dimensions. The other dimensions that did not correlate unsafe acts were the ones related to information sharing systems upon safety incidents, daily safety practices and emergency preparedness level which were interpreted not to impact the unsafe acts directly.

It was an interesting point to observe that none of the unsafe acts had a significant correlation with the number of accident experienced in the plants.Certainly not all the unsafe acts result in accidents, instead, most of the time such acts end in near misses that result in no harm. Yet, it is well known that near misses are directly related to accidents.Most probably, although the unsafe acts show did not their effect directly on the accident records, they would result in serious amount of near misses. Indeed near miss data was collected in the questionnaire so as to look deeper on the effects of unsafe acts. However, the responses were quite low which showed that the near miss awareness has not been well founded yet. Hence related analysis could not be carried out. Near miss reporting is a recent issue in plants after the enforcement of the Law of Occupational Health and Safety in 2012. This might contribute to better record keeping of near misses.

5.2. Regression Analysis

Moreoover, safety culture dimensions had no direct effect on the accidents. Nevertheless indirect effect and the effect on near misses need to be investigated. Indirect effect looked deeply by applying mediation analysis although the situation for near misses required better near miss recording and awareness. Contrary to safety culture dimensions, the leadersip awareness and effort factor was found to have a significant relationship with the accidents which showed the importance of leadership. It is expected that the accidents be decreased if safety leaders could be trained in a special way both in terms of leadership and safety. The workers rating the safety leader with higher leadership scores were the ones experiencing lower number of accidents. It could be inferred that the workers complying with the safety applications of the leader, experienced less accidents.

In the hierarchical regression analysis applied lapse type unsafe acts were found to be decreased by long working hours opposite to the expectation of causing an increase in lapse type errors due to fatigue. This showed that overtime working was not as long as to influence the working memory; the tasks were either well settled in the memory or the design of the workplace as well as memory aids related to these tasks was well organized.

The unsafe acts that had statictically significant relationship with safety culture were absentmindedness and lapses in some tasks, exceptional violations due to production over safety approach. For both of the unsafe acts the dimension having the hşghest negative effect was safety communication dimension. This means that being able to communicate their complaints, suggestions and feedbacks on health and safety application would make the workers be able to remember the tasks and would allow them to prioritize safety over work and hence avoid production oriented violations.

The unsafe acts significantly related with the leadership factors were equipment and material related perceptual errors and exceptional violations due to production over safety approach. In the demographic step of the analysis the long weekly working hours were found to increase the perceptual errors most probably due to decreased the perceptual capacity due to fatigue. The experience resulting in over confidence while working with the equipment also contributed to this type of unsafe acts.

Concerning the exceptional violations; exceptional violations in the context of this study were considered as the violations committed in case of production emergency where some safety measures are short cut due to an immediate malfunction in the plant. Such acts were found to be effected by weekly working hours in the regression analysis. Overtime working is common for the repair and maintenance workers in case of such problems. Hence the positive relationship between the long working hours and exceptional violations indicate the times of serious failures in the process. Since repair and maintenance task is one of the most dangerous tasks in a plant, it is essential that fatigue scales be applied prior to such tasks in overtime working.

5.3. Mediation Analysis

Since the safety culture dimensions did not have any significant relation in regression analysis, their indirect effect on the accidents over unsafe acts was investigated. Even in this analysis no significant result was reached which leaded to the expectation that they had impact on near misses.

For the leadership mediation applied to analyze the indirect effect on accidents, as expected leadership coaching and caring effective on exceptional violations had an impact on the number of accidents.

CHAPTER 6

CONCLUSIONS

This study was the first to focus on the work place accidents in coal and mineral processing plants in terms of safety culture, safety leadership and unsafe acts in the world. In order to contribute to the safety in processing plants, a safety culture maturity level questionnaire and an unsafe act questionnaire was generated specifically for this area. The safety leadership scale was translated from a previous study. The safety culture questionnaire was applied to 98 coal processing plant workers and the safety leadership and unsafe act questionnaires were applied to 234 mineral processing plant workers. From the factor analysis, reliability analysis, correlation, regression and mediation analysis of the data, following conclusions were drawn:

1- Safety culture, safety leadership and unsafe act questionnaires were proved highly reliable by Cronbach Alpha reliability analysis ($\alpha>.8$). Hence the safety culture questionnaire and unsafe act questionnaires generated especially for the preparation plants in Turkey are ready to be used by the plants that are willing to work on human factors to improve occupational safety. Moreover, the unsafe act questionnaire may be applied in the form of a check list in the health and safety audits by health and safety professionals or by the management in order to monitor the changes in unsafe acts.

2- Unsafe act factors were found to be in compliance with Reason's algorithm.

3- The factors investigated were found to correlate and/or contribute to the variances in unsafe acts and accidents in varying extents. Among them long weekly working hours had positive association with the safety culture, leadership coaching and caring, leadership awareness and effort perception of the workers as well as with the unsafe acts absentmindedness and lapses in some tasks and exceptional violations. This could be attributed to the fatigue effect resulting from overtime working. Hence it is suggested that the shifts be organized taking biorhythm into consideration. Furthermore, application of fatigue scales prior to critical tasks in overtime working might contribute to decreasing the related unsafe acts.

4-The safety culture dimension correlating and/or contributing to the variances in unsafe acts the most was “Communication and feedback systems”. Hence it is essential that the plants put emphasis on safety communication and encourage the workers to convey their suggestions and complaints in terms of occupational health and safety.

5- The safety culture maturity dimension on continuous improvement had positive association with the routine violations. It was inferred that a continuously improving plant might boost overconfidence in workers and give rise to such violations. Hence it might be essential to include periodical tool box trainings to increase the awareness of continuous risks.

6- Slip type acts, failure to see obstacles on the ground and machinery was the only unsafe act correlating with the work accidents directly. Hence, giving some thought to a better planning of overtime working might help reduce related accidents. Moreover, for the accidents caused by this type of unsafe act it might be more effective to employ auditory and visual warnings, good instructions and job aids instead of focusing on trainings.

7- The variance of accidents was explained by the leadership factors to some extent. Leadership was seen effective on both violation type unsafe acts. Moreover; leadership had mediation effect on the accidents over exceptional violations. Thus, the role of the safety leadership is obvious in accident prevention and it is important to focus on safety leadership for better occupational safety. Safety leaders might be trained in a special way both in terms of leadership and safety.

8-Unsafe acts other than slips were not directly related to accident. In fact not all unsafe acts result in accidents but mostly in near misses where no injury takes place. Still it is of importance to reduce the near misses as much as possible to avoid serious accidents. One drawback of this study is that the expected relation between the unsafe acts and near misses could not be studied since the near miss reporting and awareness has not developed yet in the work places. Further studies may be carried on upon development of such awareness and reporting culture.

Recommendations:

1- The other two levels of the human factor and classification system namely outside factors and preconditions for operator acts can be studied in the future to cover the whole picture in terms of economic, legislative.

2- The tools prepared can be improved to be applied in similar work areas such as cement industry.

3- The study on human factor can be expanded to the underground and surface mines of Turkey.

4- The human factors under investigation can be studied in relation with near misses.

5- Unsafe act frequency can be studied by using checklist in regular audits and by observation instead of self- completion questionnaires since errors are not committed willfully and participants might have missed some of the unsafe acts they committed but were not aware of.

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APPENDICES

APPENDIX A

QUESTIONNAIRES

ARAŞTIRMAYA GÖNÜLLÜ KATILIM FORMU

Bu araştırma, ODTÜ Maden Mühendisliği anabilim dalı doktora öğrencisi Esin Pekpak tarafından yürütülen bir çalışmadır. Bu form sizi araştırma koşulları hakkında bilgilendirmek için hazırlanmıştır.

Çalışmanın Amacı Nedir?

Bu çalışmanın amacı Kömür Yıkama ve Cevher Hazırlama tesislerinde çalışan katılımcıların iş sağlığı ve güvenliği tutum ve eğilimleriyle ilgili bilgi toplamaktır.

Bize Nasıl Yardımcı Olmanızı İsteyeceğiz?

Araştırmaya katılmayı kabul ederseniz, sizden beklenen, ankette yer alan bir dizi soruyu derecelendirme ölçeği üzerinde yanıtlamanızdır. Bu çalışmaya katılım ortalama olarak 15 dakika sürmektedir.

Sizden Topladığımız Bilgileri Nasıl Kullanacağız?

Araştırmaya katılımınız tamamen gönüllülük temelinde olmalıdır. Ankette, sizden kimlik veya kurum belirleyici hiçbir bilgi istenmemektedir. Cevaplarınız tamamıyla gizli tutulacak,toplanan veriler sadece araştırmacılar tarafından değerlendirilecektir. Katılımcılardan elde edilecek bilgiler toplu halde değerlendirilecek ve bilimsel yayınlarda kullanılacaktır. Sağladığınız veriler gönüllü katılım formlarında toplanan kimlik bilgileri ile eşleştirilmeyecektir.

Katılımınızla ilgili bilmeniz gerekenler:

Anket, genel olarak kişisel rahatsızlık verecek sorular içermemektedir. Ancak, katılım sırasında sorulardan ya da herhangi başka bir nedenden ötürü kendinizi rahatsız hissederseniz cevaplama işini yarıda bırakmakta serbestsiniz. Böyle bir durumda anketi uygulayan kişiye, anketi tamamlamadığınızı söylemek yeterli olacaktır.

Araştırmayla ilgili daha fazla bilgi almak isterseniz:

Anket sonunda, bu çalışmayla ilgili sorularınız cevaplanacaktır. Bu çalışmaya katıldığınız için şimdiden teşekkür ederiz. Çalışma hakkında daha fazla bilgi almak için Esin Pekpak ile (E-posta: epekpak@gmail.com) iletişim kurabilirsiniz.

Yukarıdaki bilgileri okudum ve bu çalışmaya tamamen gönüllü olarak katılıyorum.

(Formu doldurup imzaladıktan sonra uygulayıcıya geri veriniz).

İsim Soyad   Tarih   İmza

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KÖMÜR YIKAMA/CEVHER HAZIRLAMA TESİSLERİ ÇALIŞANLARI İŞ KAZASI ARAŞTIRMA ANKETİ

Lütfen, aşağıda listelenen soruları kendinize doğru gelen seçenekleri işaretleyerek ve doğru cevabı yazarak cevaplayınız.

- ✓ Yaşınız___________
- ✓ Bu kömür yıkama/cevher hazırlama tesisinde kaç yıldır çalışıyorsunuz?____
- ✓ Haftada kaç saat çalışıyorsunuz?_____

  Fazla mesai yapıyor musunuz? o)Hayır o)Evet (haftada________ saat)
- ✓ Tesiste hangi işleri yapıyorsunuz?
  - o Makinaların çalışmasını kontrol etmek (kırıcı, elek, bant)
  - o Numune almak
  - o Bir yerde tıkanıklık olduğunda tıkanıklığı gidermek (kırıcı, elek, silo, kömür yıkama)
  - o Triyaj (tavuklama)
  - o Bir yerden bir yere malzeme/alet taşımak
  - o Bakım ve onarım yapmak
  - o Banttan dökülen malzemeleri temizlemek
  - o Çalışma alanını temizlemek/ düzenlemek
  - o Silo ve çevresini temizlemek
  - o Vardiya defterini doldurmak
  - o Kimyasal maddeler ile çalışmak
  - o Diğer: _______________
- ✓ Aşağıdaki kişisel koruyucu donanımlardan hangisi/hangilerine sahipsiniz?
  - o Baret
  - o İş eldiveni
  - o Yalıtımlı kaydırmaz iş ayakkabısı/çizme
  - o İş elbisesi
  - o Kulaklık
  - o Toz maskesi
  - o Yüz siperliği
  - o Yüksekten düşmeye karşı emniyet kemeri
  - o Koruyucu gözlük
  - o Kimyasala karşı koruyucu kıyafet
- ✓ Yukardaki kişisel koruyucu donanımlardan en çok hangisinin kullanımında rahatsızlık hissediyorsunuz? _______________
- ✓ Size verilen iş güvenliği eğitimini ne derece yeterli buluyorsunuz?

  o) Yetersiz o) Orta o) Yeterli
- ✓ Çalıştığınız tesiste merdiven ve ıslak/kaygan bölgelerde kaymayı önleyici tedbirlerin tamamen alındığını düşünüyor musunuz? o)Evet o)Hayır
- ✓ Çalıştığınız tesiste yüksekteki işler için kullanılacak basamaklı merdiven, çalışma platformu, portatif merdiven bulunuyor mu? o)Evet o)Hayır

- ✓ Çalıştığınız tesiste işyeri düzeni konusunda eksiklik olduğunu düşünüyor musunuz?
  o)Evet o)Hayır
- ✓ Tesiste kullanılan kimyasallar ve etkileri hakkında ne derece bilgi sahibisiniz?
  o) Hiçbir bilgim yok o) Orta düzeyde bilgi sahibiyim o) Bilgi sahibiyim.
- ✓ Son 3 yıl içerisinde tıbbi rapor almanızı gerektirecek kaç tane iş kazası geçirdiniz?_____
- ✓ Son 3 yıl içerisinde işe devam edebileceğiniz şekilde hafif yaralanmalı kaç tane iş kazası yaşadınız?_____
- ✓ Son 3 yıl içinde tesiste nerelerde kaza geçirdiniz?
  - o Kırıcı
  - o Elek
  - o Bant
  - o Flotasyon
  - o Ağır ortam ayırma
  - o Filtre
  - o Diğer: _______________
  - o Tikner
  - o Depo / Ambar
  - o Pompa
  - o Silo
  - o Tesis içi yollar
  - o Merdiven/ Seyyar merdiven
- ✓ Son 3 yıl içerisinde geçirdiğiniz iş kazalarından kaç tanesinde sizin hiçbir sorumluluğunuz olmadığını düşünüyorsunuz? _____
- ✓ Son 3 yıl içerisinde kaç tane iş kazasını kıl payı (ramak kala) atlattınız?_____
- ✓ Son 3 yıl içinde çalışma arkadaşınızın geçirdiği kaç tane iş kazasına şahit oldunuz?_____
- ✓ Son 3 yıl içerisinde iş güvenliği ile alakalı herhangi bir sözlü/yazılı ikaz, disiplin cezası aldınız mı? o)Hayır o)Evet (Nedeni____)
- ✓ Tesiste yaşadığınız kaza ile ilgili önlem alınıyor mu? o)Evet o)Hayır
- ✓ Tesiste tıbbi rapor almanızı gerektiren bir kaza yaşadığınızda size kaza ile ilgili işe dönüş eğitimi veriliyor mu? o)Evet o)Hayır
- ✓ Yaşanan kazalar sonucu yapılan düzeltici faaliyetlerin kazaların tekrar yaşanmasını önleyeceğini düşünüyor musunuz? o)Evet o)Hayır
- ✓ Çalıştığınız tesiste iş güvenliğiniz yönünden en riskli bölümün neresi olduğunu düşünüyorsunuz? Neden? ____
- ✓ Bir kaza yaşadığınızda ya da bir kazaya şahit olduğunuzda kazayı raporlamanız konusunda amirlerinizden destek ve teşvik alır mısınız? o)Evet o)Hayır
- ✓ Ciddi ve açık bir tehlike ile karşı karşıya kaldığınızda amiriniz o işi tehlikelere rağmen yapmanız için size baskı yapar mı? o)Evet o)Hayır

Aşağıda listelenen durumlardan her birini hangi sıklıkta yaparsınız?
Aşağıda verilen durumların başınıza hangi sıklıkta geldiğini belirtiniz [(Her zaman(6),Sıklıkla(5), Bazen(4), Nadiren(3),Çok nadiren (2),Hiçbir zaman (1)]. Eğer soruda geçen durumu yanıtlayamıyorsanız, sizin yaptığınız iş ile ilgili değil ise “Uygun Değil” i (0) işaretleyin.
Değerlendirmeyi yaparken geçtiğimiz yıl boyunca lavvarda çalışmanızı esas alınız. Seçiminizi size göre doğru olan seçeneği karalayarak belirtiniz.

		Hiçbir zaman	Çok nadiren	Nadiren	Bazen	Sıklıkla	Her zaman	Uygun Değil
1	**Lavvar/ tesis içerisinde arkadaşlarla şakalaşmak**	1	2	3	4	5	6	u.d
2	**İşinizi zorlaştırdığı için kişisel koruyucu donanım (iş eldiveni, baret, yalıtımlı kaydırmaz iş ayakkabısı, maske) kullanmamak**	1	2	3	4	5	6	u.d
3	**Pek işe yaramadığı için kişisel koruyucu donanım (iş eldiveni, baret, yalıtımlı kaydırmaz iş ayakkabısı, maske) kullanmamak**	1	2	3	4	5	6	u.d
4	**Size verilen iş güvenliği eğitimlerine çalışmalarınızda birebir uymamak**	1	2	3	4	5	6	u.d
5	**Uyarı levhalarında yazan komutları dikkate almamak (Örneğin “yetkili olmayan giremez”, “baretini tak”, “bandın altından geçmeyiniz gibi)**	1	2	3	4	5	6	u.d
6	**Anında giderilemeyecek bir tehlikeli durumu amire bildirmek yerine kendiniz halletmek**	1	2	3	4	5	6	u.d
7	**Tatbikatlara, eğitimlere katılmamak**	1	2	3	4	5	6	u.d
8	**Birlikte çalışırken çalışma arkadaşının sözlü ya da elle işaretini yanlış anlamak (Örneğin: Dur, Gel, Doldur vb gibi)**	1	2	3	4	5	6	u.d
9	**Birlikte çalışırken çalışma arkadaşına yanlışlıkla istediğiniz işaretin/uyarının tam tersini söylemek ya da yapmak (Örneğin: “Dur” diyecekken “Gel”, “Bekle” diyecekken “Tamam Doldur” demek vb gibi).**	1	2	3	4	5	6	u.d
10	**Gereksiz, sadece zaman kaybı olarak gördüğünüz, güvenlik önlemlerini almamak**	1	2	3	4	5	6	u.d
11	**Tesis içinde malzeme taşırken zemindeki yükseltiyi, fark etmeyip takılarak düşmek**	1	2	3	4	5	6	u.d
12	**Tesis içinde ıslak zemini fark etmeyip kayarak düşmek**	1	2	3	4	5	6	u.d
13	**Kaydırmaz tabanlı iş ayakkabısı giymeden lavvar içinde yürümek**	1	2	3	4	5	6	u.d
14	**Tesis merdiven korkuluktan tutmadan inip çıkmak**	1	2	3	4	5	6	u.d
15	**Bir yükseltiden inerken basacağınız yeri görmeyip boşluğa basıp dengenizi kaybetmek**	1	2	3	4	5	6	u.d
16	**Loş/dar bölgelerden geçerken düşmek**	1	2	3	4	5	6	u.d
17	**Ağır bir yükü kaldırırken belini zorlamak/ağrıtmak**	1	2	3	4	5	6	u.d

18	Çok yüksek olmayan bir yere uzanmak için merdiven yerine başka bir yükseltiyi kullanmak	1	2	3	4	5	6	u.d
19	Oldukça yüksek bir yere uzanarak çalışmayı gerektiren bir iş için yükselen platform ile çalışmak yerine merdiven dayayıp çalışmak	1	2	3	4	5	6	u.d
20	Düşmeye karşı koruyucu kullanmamak (düşmeyi önleyici kemer)	1	2	3	4	5	6	u.d
21	Merdiveni kullandıktan sonra bir yere dik olarak, dayayarak muhafaza etmek	1	2	3	4	5	6	u.d
22	Ufak tefek hasarı olan bir merdiveni kullanırken düşmek	1	2	3	4	5	6	u.d
23	El aletlerini ve ekipmanları çalışmasını güvenli bir alanda kontrol etmeden kullanmak	1	2	3	4	5	6	u.d
24	Bazı ekipmanları ya da malzemeleri iş bitiminden sonra yerine kaldırmayı unutmak	1	2	3	4	5	6	u.d
25	Acil müdahale edilmesi gereken bir sorun çıkınca (flotasyon hücrelerinin taşması, kırıcının durması, silonun tıkanması vb gibi) güvenlik önlemlerini yok sayarak duruma müdahale etmek	1	2	3	4	5	6	u.d
26	Kullanılan bir kimyasalın ağzını açık unutmak	1	2	3	4	5	6	u.d
27	Tesis içinde açık bırakılmış bir kimyasala çarpıp üstünüze dökmek	1	2	3	4	5	6	u.d
28	Yalnızca sertifikalı çalışanların yapması gereken ama sizin de becerebildiğiniz işleri sertifikanız olmasa da yapmak	1	2	3	4	5	6	u.d
29	İş yerinizin yönergelerine her zaman birebir uymamak	1	2	3	4	5	6	u.d
30	Eğitimlerde değinilmeyen bir işi kendi deneyimlerinize göre yapmak	1	2	3	4	5	6	u.d
31	Bakım onarım işlerini tek başına yapmak	1	2	3	4	5	6	u.d
32	Üretimi aksatmamak için bakım onarım işini ekipmanı tamamen durdurmadan yapmak	1	2	3	4	5	6	u.d
33	Bakım/onarım yapılan yere başkalarının müdahalesini önleyecek tedbir almamak (uyarı levhası, etiketleme bant çekme gibi)	1	2	3	4	5	6	u.d
34	Bakım onarım işini dar bir alanda yapmak	1	2	3	4	5	6	u.d
35	Bakım onarım işinde bir aleti hasarlı olmasına rağmen kullanmak	1	2	3	4	5	6	u.d
36	İşi yetiştirmek için zaman alan bazı güvenlik önlemlerini almadan çalışmak	1	2	3	4	5	6	u.d
37	Bakım onarım işi yaparken başınızı bir yere çarpmak	1	2	3	4	5	6	u.d
38	Onarım işinde bir parçayı sökerken elini sıkıştırmak	1	2	3	4	5	6	u.d
39	Bakım onarım işi yaparken uzun süre zorlu bir pozisyonda çalışmak	1	2	3	4	5	6	u.d
40	Bakımı yapılmakta olan bir cihazı kazara çalıştırmak	1	2	3	4	5	6	u.d
41	Tesisatta elektrik olup olmadığını kontrol etmeden işe girişmek	1	2	3	4	5	6	u.d

42	Tıkanıklık giderme işleri yaparken (su borusu, besleyici, bunker, silo vb. yerlerde) işe özel araç/gereç yerine size uygun görünen başka bir araç/gereç kullanmak	1	2	3	4	5	6	u.d
43	Üretimi aksatmamak için tıkanıklık giderme işini makinayı durdurmadan yapmak	1	2	3	4	5	6	u.d
44	Bir yerde tıkanıklığı açma işini yapmadan önce makinayı durdurmayı unutmak	1	2	3	4	5	6	u.d
45	Kontrol ettiğiniz halde bir yerde tıkanıklık olduğunu gözden kaçırmak (kırıcı, elek vb gibi)	1	2	3	4	5	6	u.d
46	Makinaların çalışmasını kontrol ederken bir makinayı kontrol etmeyi unutmak (değirmen, kırıcı, pompa)	1	2	3	4	5	6	u.d
47	Silo temizliği yaparken kayarak düşmek	1	2	3	4	5	6	u.d
48	Bant çalışır haldeyken, banttan dökülen malzemeyi temizlerken banda çarpmak/takılmak	1	2	3	4	5	6	u.d
49	Bandın çalışmasını kontrol ederken bir yerinizi bant ile tambur arasına sıkıştırmak	1	2	3	4	5	6	u.d
50	Dar bir bölgeden geçerken banda çarpmak	1	2	3	4	5	6	u.d
51	Bantta bakım onarım yaparken elinizi sıkıştırmak ya da bir yerinize parça düşürmek	1	2	3	4	5	6	u.d
52	Çalışır durumdaki hasarlı prizleri kullanmayı sürdürmek	1	2	3	4	5	6	u.d
53	Çalışır durumdaki hasarlı alet ve ekipmanları bir hasarı olduğunu fark etseniz de kullanmak	1	2	3	4	5	6	u.d
54	Size etkilerini bilmediğiniz kimyasala temas etmek (örneğin kimyasalları bir yere dökerken)	1	2	3	4	5	6	u.d
55	Ne olduğunu bilmediğiniz bir kimyasalı tesis içinde taşımak	1	2	3	4	5	6	u.d
56	Numune alırken dengenizi kaybedip sendelemek	1	2	3	4	5	6	u.d
57	Kimyasal madde kullanımı gerektiren işlerde çalıştığınız kimyasalın güvenlik bilgi formunu okumadan çalışmak	1	2	3	4	5	6	u.d
58	Vardiya değişiminde bir sonraki vardiya bildirilmesi gereken bir şeyi bildirmeyi unutmak	1	2	3	4	5	6	u.d
59	Önceki vardiyadan gelen bir bilgiyi unuttuğunuz için kaza geçirmek	1	2	3	4	5	6	u.d
60	Önceki vardiyadan yanlış bilgi verildiği için kaza geçirmek	1	2	3	4	5	6	u.d
61	Sizin için tehlikeli olsa da bir işi yapmayı kabul etmek	1	2	3	4	5	6	u.d
62	Bir kaza yaşadığınızda ya da bir kazaya şahit olduğunuzda kazayı tereddüt etmeden rapor etmek	1	2	3	4	5	6	u.d
63	Ciddi ve açık bir tehlike ile karşı karşıya kaldığınızda verilen görevi yapmaktan kaçınıp ilgili amirinize bilgi vermek	1	2	3	4	5	6	u.d
64	Ciddi ve açık bir tehlike ile karşı karşıya kaldığınızda amirinizden gelen baskıdan dolayı o işi yapmak	1	2	3	4	5	6	u.d

Kendisine bağlı çalıştığınız kişiyi (usta/amir) ya da iş yerinizde iş güvenliğinden sorumlu kişiyi göz önünde bulundurarak aşağıda listelenen maddeleri katılım durumunuza göre işaretleyiniz
[(Tamamen katılıyorum (6),Oldukça katılıyorum (5), Katılıyorum (4), Kısmen katılıyorum (3),Pek katılmıyorum (2),Hiç katılmıyorum(1)] Değerlendirmeyi yaparken geçtiğimiz yıl boyunca lavvarda çalışmanızı esas alınız. Seçiminizi size göre doğru olan seçeneği karalayarak belirtiniz.

	Hiç katılmıyorum	Pek katılmıyorum	Kısmen katılıyorum	Katılıyorum	Oldukça katılıyorum	Tamamen katılıyorum	Uygun Değil
1. İş güvenliği konusunda işini dürüstçe yapar.	1	2	3	4	5	6	u.d
2. İş sağlığı ve güvenliği kurallarına uyarak örnek oluşturur.	1	2	3	4	5	6	u.d
3. Çalışanların iş güvenliğinin önemini kavramasına yardımcı olur.	1	2	3	4	5	6	u.d
4. İş güvenliği konusunu açık ve net bir şekilde anlatır.	1	2	3	4	5	6	u.d
5. İş güvenliği ile ilgili konularda karar alırken çalışanların katılımıyla alır.	1	2	3	4	5	6	u.d
6. İş güvenliği ile ilgili bir görüşü resmederek anlatır.	1	2	3	4	5	6	u.d
7. Çalışanlar arasında uyumlu bir çalışma ortamı yaratır.	1	2	3	4	5	6	u.d
8. İş güvenliği ile ilgili malzemeleri adil bir şekilde dağıtır.	1	2	3	4	5	6	u.d
9. İş güvenliğini geliştirmek için çalışanların önerilerini kabul eder.	1	2	3	4	5	6	u.d
10. Çalışanların güvenli bir şekilde çalışma performansından emindir.	1	2	3	4	5	6	u.d
11. Çalışanların iş güvenliği ile ilgili ihtiyaçlarını karşılamak için çaba sarf eder	1	2	3	4	5	6	u.d
12. Çalışanların güvenli çalışma adına gösterdikleri başarıları bilir.	1	2	3	4	5	6	u.d
13. Çalışanların güvenli çalışma hedeflerine ulaşılacak şekilde çalışmaları yönünde kesin emirler verir.	1	2	3	4	5	6	u.d
14. Çalışanların güvenli çalışmasını takdir eder ve ödüllendirir.	1	2	3	4	5	6	u.d
15. Güvenli çalışma ile ilgili düzenlemelerin hayata geçirilmesini destekler.	1	2	3	4	5	6	u.d
16. Çalışanlardan güvenli çalışma mevzuatına uygun çalışmalarını talep eder.	1	2	3	4	5	6	u.d
17. Çalışanlardan güvenlik zaaflarını sürekli düzeltmeyi talep eder.	1	2	3	4	5	6	u.d
18. Çalışanların güvenli çalışıp çalışmadığını sürekli gözetir ve denetler.	1	2	3	4	5	6	u.d
19. Çalışanların güvenli çalışma hedeflerine ulaşılacak şekilde çalışmaları yönünde kesin emirler vermez.	1	2	3	4	5	6	u.d

Aşağıda verilen A,B,C,D,E seçenekleri, iş sağlığı ve güvenliğine (İSG) yaklaşım açısından farklı bir lavvarı tanımlamaktadır.

Lütfen beş farklı lavvar tanımı okuyunuz ve çalıştığınız lavvarı **EN ÇOK** yansıttığını düşündüğünüz tanımı işaretleyiniz.

-A-	-B-	-C-	-D-	-E-
Lavvarda çalışma koşullarının gelişmesine yönelik herhangi bir hedef koyulmaz. Kar amacı ön plandadır, İş sağlığı ve güvenliği ile ilgili maliyetler gereksiz görülür. İş sağlığı ve güvenliğine yönelik yatırımlar iyileştirme amacından çok cezadan kaçınma için göstermelik olarak yapılır.	Lavvarda gelişime yönelik herhangi bir hedef koyulmaz. Günü kurtaracak yatırımlar planlama olmaksızın yapılır. Bir kazanın gerçekleşmesinin ardından iş kazasının gerçekleştiği alana yönelik maliyeti çok yüksek olmayacak şekilde satın alınması gereken malzemelere yatırım yapılır. Lavvardaki İSG yatırımları cezadan kaçınmak içindir.	Kağıt üzerinde göstermelik bir iş sağlığı ve güvenliği politikası göstermelik olarak vardır. Lavvarda çalışma koşullarını iyileştirmek için bir hedef koyulur ama bu hedefe yönelik eylem planı ya da takip yoktur. İş sağlığı ve güvenliğine yönelik yatırım planları vardır. İlgili yatırımlar tamamen olmasa da göstermelik olarak yapılır. İlk bakışta görülebilen ekipman muhafazaları, kişisel koruyucu donanım gibi kalemlere yatırım yapılır.	İş sağlığı ve güvenliği politikası vardır. Riskli görülen bölgelerde iş sağlığı ve güvenliği önlemleri için bütçeyi sarsmayacak şekilde planlı yatırımlar yapılır. Yatırımlar olası kazaları önleyecek şekilde yapılır. İş sağlığı ve güvenliğini iyileştirmeye yönelik hedef koyulur. Bu hedeflere ulaşıp ulaşılmadığı sıkı sıkıya takip edilmez.	İSG politikası vardır ve bu politikaya sadık kalınır. İş sağlığı ve güvenliği yönünden son teknoloji ile donatılmış ekipmanlara yatırım yapılır. İş kazalarının ve risklerin azaltılması, çalışma koşullarının iyileştirilmesi hedeflenir. Hedeflere ulaşma başarısı takip edilir. Çalışanlar koyulan hedeflere ulaşılması için katkıda bulunur. İş sağlığı ve güvenliği koşullarının sürekli geliştirilmesi ile görevli tam zamanlı çalışan bir iş güvenliği uzmanı bulunur.

-A-	-B-	-C-	-D-	-E-
İş sağlığı ve güvenliği kurallarının bir işe yaramadığı ve üretimi aksattığı düşünülür. Çalışanlar yaptıkları işlerin tehlikelerini bilmez, baret dahi takmazlar. Çalışanlara sağlık gözetimi yapılmaz. Çalışanların çoğu geçim kaygısından dolayı açıkça tehlikeli olan işleri yapmaya itiraz etmezler. Çalışana açıkça tehlikeli olan bir işin zorla yaptırılıp yaptırılmaması ustabaşı ve amirlere bağlıdır.	İş sağlığı ve güvenliği kuralları çoğunlukla gereksiz görülür ve bu kurallara uymak kişiye bağlıdır. Bazı kurallara uyulur. Örneğin bant akışından kürekle numune alma işi sırasında şakalaşılmaz. Çalışanlar yaptıkları iş ile ilgili tehlikeleri başlarına gelenlerden ve ageanan İSG olaylarından kısmen bilirler. Sağlık gözetimi yapılmaz yalnızca bir kez işe giriş muayenesi olur Çalışana açıkça tehlikeli olan bir işin zorla yaptırılıp yaptırılmaması ustabaşı ve amirlere bağlıdır. Amir idareten önlem çalışana bu tehlikeli işi yaptırmaya çalışabilir.	Lavvarda iş sağlığı ve güvenliği kurallarına özellikle iş güvenliği uzmanı ve yöneticiler uyar. Bir denetim olacağı zaman kurallara uyuluyor gibi gösterilir. İş yerinde uyarı levhaları, tabelalar, afişler asılmıştır. Göstermelik kişisel maruziyet (toz, gürültü) ölçümleri yapılır. Tüm çalışanlara kişisel koruyucu donanım dağıtılır ve aldığına dair formlar imzalatılır. İş ayakkabısı ve kısmen de baret dışında kişisel koruyucu donanım kullanılmaz. Sağlık gözetimleri yapılması zorunlu olan sıklıkta yapılır. Meslek hastalıkları ile ilgili işyeri hekimi kontrollerini yapar ve kayıt tutar. Açıkça tehlikeli işler kısmen önlem alınarak yapılır.	İSG kurallarını tüm çalışanlar ve yönetim ciddiye alır bu kurallara uygun çalışmak alışkanlık haline gelmiştir. İş sağlığı ve güvenliği ile ilgili sorumluluk iş güvenliği uzmanı, amirler ve tüm çalışanlar tarafından paylaşılır. Kişisel koruyucu donanım yapılan maruziyet ölçümlerine uygundur. Çalışanlar yaptıkları iş ile ilgili tehlikeleri aldıkları eğitimlerden ve iş deneyimlerinden bilirler. Sağlık gözetimleri zorunluluğun ötesinde ihtiyaç duyulan sıklıkta yapılır. Örneğin: işitme testleri, akciğer taramaları vb. Bu taramalar sayesinde meslek hastalıklarının takibi yapılır. Çalışanlar bütün gerekli önlemlerin alınmadan açıkça tehlikeli bir işi yapmaz.	İSG yapılan her işin ayrılmaz bir parçasıdır. Kurallarına tüm çalışanlar, ustabaşı ve mühendisler ve üst yönetim uyar, bu kuralları herkes benimsemiştir. İş güvenliği uzmanı sık sık gözetim tesis içerisinde dolaşarak tespitlerde bulunur. Çalışanlar maruziyet ölçümlerine göre mümkün olduğunca tozlu ve gürültülü ortamların dışında operatör kumanda odasından çalışır. Çalışanlar yaptıkları işin tehlikelerini teorik eğitimlerden, işbaşı eğitimlerden ve vardiya öncesi hatırlatmalardan dolayı bilirler. Sağlık gözetimleri düzenli olarak yürütülür, meslek hastalıkları takibi yapılır. Çalışanlar etkinliklerle sağlıklı ageama teşvik edilir. Açıkça tehlikeli bir işle karşılaşıldığında ilgili alanda iş durdurulur ve sorun tamamen giderilmeden kesinlikle faaliyete geçilmez.

-A-	-B-	-C-	-D-	-E-
Sık sık iş kazaları ageanır. Bakımsızlıktan çürümüş profillerin düşüp yaralanmaya sebep olduğu iş kazaları olur. Hareket halindeki eleğe çarpma sonucu yaralanma olur. Numune alma işi yapılırken uzuv kaptırma kazaları olabilir. Ramak kala olaylar ve ufak tefek görülen kazalar (küçük kesikler, çarpmalar) hiç bir çalışan tarafından bildirilmez. Böyle kazalar önemsenmez. Çalışan yalnızca sağlık raporu almasını gerektirecek kazaları ustabaşına sözlü olarak haber verir.	Kayma takılma düşme ve merdivenden düşme gibi kazalar ageanır. Numune alma işi yapılırken uzuv kaptırma kazaları olabilir. Elektrik işlerinde bakımsız tesisattan kaynaklanan kazalar olabilir. Ramak kala olayları çalışanlar sohbet arasında birbirlerine söyleyebilirler ancak bir bildirim olmaz. Hafif yaralanmalı bir kaza ageandığında ustabaşı durumdan haberdar olur fakat üst mevkilere bildirimde bulunulmaz. Sağlık raporu alınması gereken en az bir kaç gün iş görmezlik ile sonuçlanan kazalar ustabaşı ve sorumlu mühendis tarafından bilinir.	Bant konveyör motoru tamir edilirken bir başkası tarafından motorun çalıştırılması gibi durumlarda el kol kaptırma kazası ageanabilir. Numune alma işinde uzuv kaptırma kazaları sık ageanmaz. Elektrik işlerindeki kazaların olma olasılığı azdır. Ramak kala ve iş kazası matbu tutanakları bulunur. Ramak kala olaylar bildirilmez. Kaza kayıt formu doldurulur ve dosyalanır. Bu kaydın tutulmasında şeffaf olunmaz, durumu örtbas etme eğilimi olabilir. Sağlık raporu alınması gereken kazalar ustabaşından başlayarak silsile ile üst mevkilere bildirilir. Kaza ile ilgili sorumluluk her zaman için başka birim/ amire atılmaya çalışılır.	Bakım onarım işi yapılırken bir aleti eline vurmak gibi ufak tefek kazalar ageanır. Zemine dökülmüş tek tük malzemeye takılıp düşme, numune alırken dengeyi kaybedip düşme, nadiren ufak elektrik çarpmaları gibi kazalar olabilir. Ramak kala olaylar ustabaşına bildirilir. Çalışanın rapor almasını gerektirecek bir kaza ageandığında ustabaşı kazayı mühendise bildirir ve sağlık personeli kaza çağrılır. Kaza kayıt formu şeffaflıkla ve doğrulukla doldurulur. Çalışan kendisine suç yüklenmeyeceğini bilir. Kaza olması durumunda aranması gereken telefon numaraları telefonların yanında görülür bir şekilde tutulur. Sakat kalma, ölüm ile sonuçlanan kazalar üst yönetime aktarılır.	Her türlü önlem alındığı ve takip edildiği için iş kazası sayısı yok denecek kadar azdır. Bu lavvarda gerçekleşen kazalar çalışanın özgüveni ve çalıştığı tesise olan güveninden dolayı basit bir ayrıntıyı atlamaktan kaynaklanabilir. Elektrik kazaları nadiren görülür ve sabotajdan kaynaklanabilir. Ageanan ramak kala olaylar ve bildirilen hafif, orta, ciddi şiddetteki kazalar ile ilgili tutulan kayıtlar haftalık olarak işletme müdürüne bildirilir. Kaza kayıt formu şeffaflıkla ve doğrulukla doldurulur. Çalışan kendisine suç yüklenmeyeceğini bilir. Kaza gerçekleşir gerçekleşmez tesiste ilk yardım konusunda yetkili ve bilgili kişiye ulaşılır.

-A-	-B-	-C-	-D-	-E-
Lavvarda, hukuka intikal etmesi gerekmeyen iş kazalarının nedenleri araştırılmaz. Kazaların üstü kapatılır. Günü kurtarma anlayışı vardır. Bir iş kazası olduğunda cezadan kaçma yolları araştırılır.	Lavvarda ageanan iş kazalarının nedenleri ile ilgili derinlemesine bir araştırma yapılmaz. Adli bir durum olmaması durumunda çalışanlar susturulur. Bir kaç gün iş görmezlikle sonuçlanan bir kaza varsa ustabaşı yüzeysel olarak olayı soruşturup iş güvenliği uzmanına bilgi verir. Kazaların üstü kapatılmaya çalışılır	Kazanın incelenmesi kazanın ne kadar ciddi görüldüğüne bağlıdır. Birkaç gün iş görmezlik ile sonuçlanan bir kaza için ustabaşı ve iş güvenliği uzmanı yüzeysel bir araştırma yapar. Uzun süre iş görmezlik ile sonuçlanan bir kaza işletme müdürünün ve personel müdürünün dahil olduğu bir ekip tarafından iş güvenliği uzmanı ve vardiya mühendisinden bilgi alınarak yürütülür. Bu soruşturma yöneticilerin kazada sorumlulukları olmadığını ispatlamak üzere gerçekleştirilir.	Lavvarda gerçekleşen bir iş kazasını kimin araştıracağı kazanın ciddiyetine bağlıdır. Bildirilen kazaları ustabaşı ile mühendis birlikte araştırır ve yerinde inceleme yapar. Çok ciddi bir kaza ise araştırma ekibine şefler de katılır. Kazayı ageayan çalışandan bilgi alınır. Kazayı gören çalışanlardan bilgi toplanır. Kaza bir ekipman ile bağlantılı ise o ekipmandan sorumlu çalışan ile görüşülür.	İş kazalarının araştırılması için derhal bir komisyon (Komisyonda işyeri hekimi, iş güvenliği uzmanı, işletme müdürü, mühendis, ustabaşı ve çalışanlardan bir kişi) kurulur. Komisyonun amacı kazanın oluşum nedenlerini ortaya çıkarmak ve çözüm getirmektir. Bu komisyon ageanan kaza ile ilgili evraksal bilgileri toplar. Örneğin kaza bir bant konveyör rulmanının onarımı sırasında gerçekleşmiş ise rulmanın bağlı olduğu sistemin arıza-bakım onarım kayıtları incelenir. Yerinde inceleme yapılır. Hem kazayı ageayan çalışanlarla hem de kazaya şahit olan çalışanlarla detaylı olarak görüşülür.

-A-	-B-	-C-	-D-	-E-
İş kazalarından ders çıkarılmaz. Yalnızca kazayı ageayan çalışan bir süre kaza ageadığı duruma dikkat eder ancak bu geçici olur. Örneğin bant konveyör çevresini temizlerken üzerine malzeme düşen bir çalışan bir süre malzeme gelişini görecek şekilde durarak çalışır.	Ustabaşı bildirilen bir iş kazasından sonrası edindiği bilgiyi vardiya mühendisine sözlü olarak iletir. Lavvarda ciddi görülen bir kaza ageandıysa iş güvenliği uzmanı önlem alma işinin başında durur. Ancak bu önlem alma işi kapsamlı olmaz yalnızca sorun ageanan bölge ile sınırlı kalır. Ageanan kazalardan ders çıkarma olur ancak yüzeysel ve kazanın ageandığı işle kısıtlı kalır. Ustabaşı kaza ageanan bölge ile ilgili çalışanlara ayaküstü tembihte bulunur.	Araştırılan iş kazası ile ilgili bir kaza raporu oluşturulur. Bu raporda genellikle kaza nedeni çalışan kişinin dikkatsizliği, dalgınlığı şeklinde gösterilir. Lavvarın durumundan ve yönetimden kaynaklanan eksikliklere bu raporda yer verilmez. Raporda soruna yönelik önlemler önerilir. Bu rapor resmi mercilere arz edilmek üzere dosyalanır. Kazadan ders çıkarma olmaz.	İş kazasının nedenlerinin araştırılması sonucu elde edilen bilgi bir rapor haline getirilerek işverenin de üyesi olduğu iş sağlığı ve güvenliği kuruluna sunulur. Ayrıca bu bilgiler çalışanlar ile de sözlü olarak paylaşılır. Mühendis ve ustabaşı çalışanları vardiya öncesinde veya çalışanların mola vaktinde ageanan kaza, kazanın nedenleri, alınan önlemler ve çalışanların da dikkat etmesi gereken noktalar hakkında sözlü olarak bilgilendirir.	Kazanın araştırılmasından ortaya çıkan bilgiden kapsamlı bir rapor hazırlanır. Ortaya çıkan rapor şirket ortakları ile ve benzer tesisler ile paylaşılır. Önemli görülen noktalar e-posta yolu ile tüm çalışanlara iletilir. Kaza ile ilgili pratik bilgiler çalışanlara yapılan kısa toplantılarla aktarılır. Gerekli görülürse talimatlarda değişikliğe gidilir. Kaza ile ilgili elde edilen bilgi, hazırlanan raporun sonuçları, fotoğraflar eğitim notlarına eklenir.

-A-	-B-	-C-	-D-	-E-
Çalışanlar İSG ile ilgili şikayetlerini ya da önerilerini şefleri ile paylaşmaz. Üst mevkilere şikayette bulunurlarsa bunun kendilerine karşı kullanılmasından, cezalandırılmaktan, kovulmaktan çekinirler. Çalışanlar öneri veya şikayetlerle şekilde dikkat çekmekten kaçınırlar. Vardiyalar arası iletişim zayıftır, ayaküstü sohbet şeklinde sağlanır ve yalnızca devam edilmesi gereken işler var ise onlar bildirilir.	Çalışanlar iş sağlığı ve güvenliği ile ilgili şikayetlerini bazen ustabaşına sözlü olarak iletir. Ustabaşı çoğunlukla şikayetleri olumsuz karşılar. Çalışanlar dikkate alınmayacaklarını düşündükleri için bu önerilerini ustabaşına söylemezler. Yalnızca başından iş kazası geçen bir çalışanın o kaza ile ilgili önerisi varsa ve bu öneri bir ek mali yük getirmiyorsa dikkate alınabilir. Vardiyalar arası bilgi aktarımı sözlü olarak yapılır ve yapılacak işler aktarılır. Bir iş kazası sonucu değişiklik yapılan bir bölüm varsa o söylenebilir.	Çalışanlar iş sağlığı ve güvenliği ile ilgili şikayetl ı söyler. tleri genelde lir ve geçiştirir. Şikayetler arasında önemli bulduklarını iş güvenliği uzmanına haber verir. İş güvenliği uzmanı bunlardan gerekli gördüklerini kayıt altına alarak dosyalar. Çalışanlar önerilerini üst yönetime bildirdiklerinde dikkate alınmayacaklarını düşünürler. Vardiya defterleri tutulur. Önceki vardiyada tamamlanan işler ile ilgili detaylı bilgi verilir. Sorun olan bölgeler sözlü olarak da belirtilir.	Çalışanlar lavvarda kendilerine zarar verebileceğini düşündükleri durumları (örneğin: muhafazasız bant konveyör motoru) derhal bildirerek sorunun giderilmesini talep eder. Amirler çalışanların öneri ve şikayetlerini paylaşmasını takdir eder. Çalışanların kendi hatasını paylaşıp paylaşmaması işyerindeki ilişkilerine ve kendi kişiliklerine bağlıdır. İsimsiz anketlerle çalışanlar fikirlerini çekinmeden paylaşır. Vardiyada yapılmış olan ve yapılacak işlerin yanı sıra oluşabilecek sıkıntılar görüşülür. Önceki vardiya ile ilgili bilgiye ihtiyaç duyulduğunda vardiya kayıt defterinde detaylı bilgiye ulaşılır. Yapılan her iş kayıt altındadır.	İletişim çok yönlüdür. İş sağlığı ve güvenliği ile ilgili olayları hem çalışanlar kendi arasında görüşür hem de amirlerine konu ile ilgili öneri ve şikayetlerini bildirirler. Çalışanlar iş sağlığı ve güvenliği ile ilgili hataları olsa da paylaşmaktan çekinmezler, suçlanmayacaklarını bilirler. verdikleri bilginin yalnızca işyerini daha güvenli yapmak için kullanılacağına güvenirler. Ayrıca üst yönetimden çalışanlara mevzuat, yeni teknolojiler, tesiste yapılan değişiklikler ve iyileştirmeler ile ilgili bilgi akışı vardır. Genel vardiya defterinin yanı sıra her ekipmanın başında vardiya defteri bulunur. Vardiya sırasında iş aktarımı çalışanların ekipman başında sözlü bildirimi ile yapılmaktadır.

-A-	-B-	-C-	-D-	-E-
İş sağlığı ve güvenliği eğitimi yapılmaz. İş deneyimli bir çalışanın yanında çalışarak öğrenilir. İşi yeni öğrenen biri, yanında çalıştığı kişi iş sağlığı ve güvenliğini ne derece önemsiyorsa konuyu o kadar öğrenebilir. Örneğin bir çalışan tiknere malzeme çıkarırken işi çabuk bitirmek için merdivenden elinde fazla yük taşıyarak çıkıyorsa yeni başlayan çalışan da aynı şekilde davranır.	İş sağlığı ve güvenliği eğitimleri tesisi içerisinde kalabalık bir grubun sığabileceği herhangi bir mekanda (varsa yemekhane) yapılır. Bu eğitim bir kere üstünkörü yapılır ve tekrarlanmaz. Eğitimdeki bilgiler çalışma hayatına uygulanabilir olmaz. Çalışanlar eğitimlerden faydalanamazlar ve eğitimden kaçınma eğilimindedirler ama onlar istekli olsa da amir işin devam etmesi için eğitime baştan sona katılmalarına müsaade etmez. Eğitim bir amir tarafından veya iş güvenliği uzmanı tarafından verilir.	İş sağlığı ve güvenliği eğitimleri tesisi içerisinde kalabalık bir grubun sığabileceği herhangi bir mekanda (varsa yemekhane) yapılır. Sırf yasal zorunlulukları yerine getirmek amacıyla yapılan eğitimde görseller ve pratik bilgi yoktur. Eğitimi iş güvenliği uzmanı verebilir ya da bu iş ile ilgilenen bir şirketten hizmet alınır. Eğitimler ihtiyaç olan sıklıklarla olmasa da zaman zaman tekrar edilir. Eğitim aldığına dair mutlaka her çalışanın imzası alınır ve çalışana eğitim aldığına dair belge verilir.	İş sağlığı ve güvenliği eğitimi, eğitime ayrılmış, özel bir salonda yapılır. Eğitim iş güvenliği uzmanı tarafından görsel sunumlar kullanılarak verilir. Eğitime tüm çalışanlar, tüm ustabaşı ve mühendisler katılır. Eğitimler teorik bilgi ile birlikte uygulamaya yönelik bilgilere de yer verilir. Çalışanlara güvenli çalışma, güvensiz çalışma örnekleri fotoğraflarla gösterilir. Eğitimlerin sonunda sınav yapılır.	Eğitimlerde görsel sunumların yanı sıra uygulama atölyelerinde uygulamalı eğitimlere yer verilir. Eğitmenler gerekli eğitimleri almış en üst seviye yetkili iş güvenliği uzmanları tarafından verilir. Periyodik eğitimlerin yanı sıra lavvarda büyük değişiklikler olduğunda ek eğitimler yapılır. Eğitimde grup çalışmaları yapılarak cevher hazırlama tesislerinde gerçekleşmiş kazalar üzerinden önlem fikirleri geliştirilir. İnteraktif bir alan oluşturulur ve çalışanların deneyimlerini paylaşmaları için zaman ayrılır. Eğitimin elektrik ile ilgili pratik kısmı tesis içinde üretimin durduğu bir zamanda yapılır.

-A-	-B-	-C-	-D-	-E-
Gündelik işler herhangi bir önlem alınmaksızın yürütülür. Lavvarda bakım onarım işleri plansızca, hızlı bir şekilde halledilmeye çalışılır, iş güvenliği önlemi için zaman harcanmaz. Lavvarda numune alma hiçbir önlem almadan bant akışından kova ve kürekle yapılır. Kişisel koruyucu donanımlar dahi kullanılmaz. Elektrik işleri yapılırken iş çabuk bitsin diye enerji kesilmeden çalışılmasına yönelik baskı olur.	İşe başlamadan önce herhangi bir önlem alınmaz. Lavvarda daha önce iş kazası ageanan bir iş yapılıyorsa o bölge için üstünkörü önlem alınır. Bir alet bulunamadığında yerine tam uygun olmasa da başka bir alet kullanılır. Lavvarda üretimin kesintisiz devam etmesi için bakım onarım işleri zamanla yarışarak yapılır. Lavvarda numune alma bant akışından kova ve kürekle yapılır Elektrik işlerinde kullanılması gereken yedekleme motoru vardır ancak uygun şekilde temiz ve korunaklı muhafaza edilmez.	Çalışanlar işe başlarken kendini koruyacak kadar önlem a Zaman z onarım işlerinde işi hızla bitirmek gerektiği için güvenlik önlemleri atlanır. Lavvarda her çalışana mutlaka kişisel koruyucu donanım verilir ve bazı çalışanlar bu kişisel koruyucu donanımları bildiği kadarıyla kullanır. Çalışma izin sistemi vardır ancak kullanılmaz.	İşler önceden planlanarak yapılır. İşe başlamadan önce iş sağlığı ve güvenliği şartlarının yerine getirilip getirilmediği gözle kontrol edilir. Hasarlı aletler kullanılmaz ve diğer aletlerden ayrılarak tamire gönderilir ya da bertaraf edilir. Kişisel koruyucu donanım kullanımı alışkanlık haline gelmiştir. Elektrik işi yapan çalışanların yorgun, dalgın, uykusuz olup olmadığı ustabaşı tarafından takip edilir.	İşler haftalık, aylık, yıllık olarak planlanır. Yapılacak işin planlanmasında önceki vardiyadan gelen bilgilerden faydalanılır. Rutin dışı işler çalışma izni ile yapılır. İşe başlamadan önce önlemlerinin alındığına dair kontrol listeleri ile durum tespiti yapılarak tüm önlemlerin alındığından emin olunur. Bakım onarım işlerinin zaman baskısı olmaksızın yürütülmesi için yedekli sistemler ile çalışılır. Örneğin bir pompa arızası ile ilgili çalışılırken başka bir hattan akış sürdürülür. Her elektrik teknisyeninin kendine ait elektrik alet ve cihazları vardır. Ayrıca bu alet ve cihazların birer yedeği de malzeme dolabında tutulur. Elektrik panolarının enerji kesilmeden açılmadığı sistemler kullanılır.

-A-	-B-	-C-	-D-	-E-
Lavvarda zemindeki su, yağ ve çamur birikintileri ile ilgili önlem alınmaz. Lavvar karma karışık ve döküntü görünümdedir. Merdiven korkulukları çürük, kırık, basamakları kaygan olur. Ekipmanlar çalışmaz hale gelene kadar onarılmadan kullanılır. Eleklerin yanında korkuluk olmaz Numune almakta kullanılan paslı hale gelmiş kova ve kürekler rastgele bir yere bırakılmıştır. Elektrik işlerinde kullanılan alet ve cihazlar yetersiz sayıdadır. Elektrik panoları açıkta ve yıpranmış durumdadır.	Lavvarda zeminde su, yağ ve çamur birikintileri olur. Temizlik yapılmaz. Lavvarın ilk bakışta görünen yerler biraz daha tertipli tutulur. Bakımsız bölgelerde ve ekipmanlarda kaza ageanana kadar müdahale edilmez. Örneğin caraskal ve kriko kaçırmalar yapsa da bir kaza ageanana kadar kullanılmaya devam edilir. Numune almakta kullanılan kürek ve kovanın sabit tutulduğu bir alan yoktur çalışan kullanacağı zaman yanında götürür. Elektrik işlerinde kullanılan alet ve cihazlar yetersizdir. Elektrik panoları kapalı tutulmaz, panoların içine gereksiz malzemeler koyulur.	Bazen kayma düşmenin çok olduğu yerlerde (merdiven) zeminin kaba temizliği yapılır. Göz önünde olan yerler nispeten düzenlidir. Ekipmanların döner aksamları çoğunlukla muhafazalıdır. Büyük ekipmanlardaki ufak tefek aksaklıklar göz ardı edilir. Kullanılan aletlerinin kaybolmaması için dağınık da olsa bir malzeme dolabı bulunur. Numune almakta kullanılan kürek ve kovanın sabit tutulduğu bir alan vardır. Elektrik panoları düzenli ve kapalıdır. Elektrik panoları kilitli tutulur. Pano anahtarı operatör ve teknisyende bulunur. Bir anahtar her elektrik panosunu açar.	Zemin sık sık temizlenir, çamur ve su birikintisi olmaz. Ekipmanlar çalışır vaziyette ve iyi durumdadır. Aletler düzenli ve sistemli bir malzeme dolabı içerisinde bulunur. Numune almak için kürek kova yerine otomatik numune alma sistemleri kullanılır Elektrik panoları düzenli ve kilitlidir. Her elektrik teknisyeninin kendine ait elektrik alet ve cihazı vardır. Elektrik panoları kilitli tutulur. Elektrik panolarında yapılmış işlemler ile ilgili kayıtlar panoya yakın bir yerde tutulur.	Vardiya boyunca zemin temizliği yapılarak çamur birikintileri önlenir. Kritik bölgelerde örneğin bakım onarım yapılan alanlarda stimli tabancalarla basınçlı hava yardımıyla zemindeki ıslaklık giderilir. Tüm ekipmanlar muhafazalıdır. Numune alma işlemi için otomatik sistemler vardır. Tesiste sürekli mekanik ve elektronik kontroller yapılır. Ekipmanlar kullanılmadan önce çalışıp çalışmadıkları kontrol edilir. Bu aletlerin düzenli ve sistemli şekilde saklandığı bir malzeme dolabı vardır. Bir çalışan bu aletlerin kullanımını takip etmekle sorumludur.

-A-	-B-	-C-	-D-	-E-
Acil durum ile ilgili hiçbir çalışma olmaz. Tatbikat yapılmaz. Yangınla mücadele ekipmanları yerinde olmaz. Acil durum ekibi yoktur. Bu konu tam olarak angarya olarak görülür	Acil durum ile ilgili hiçbir çalışma olmaz. Yangınla mücadele ekipmanları göstermelik olarak bulunur ancak bakım/ dolumları kontrol edilmez. Acil durum ekipleri yoktur. Eğitimli acil durum ekipleri yoktur. Çalışanlar bir acil durumda genel kültür olarak bildikleri bilgilere dayanarak davranırlar	Acil durum planları vardır ancak bu plan yalnızca bir dosyad Acil dı düzenl ele ekipmanı, acil durum yönlendirmeleri) vardır. Ancak çalışanlara bu konuda haber, bilgi verilmez. Acil durum ekipleri bir isim listesi olarak bulunur. Bu ekiplerde yer alan kişilerin ekiplerde görevlendirildiğinden haberi olmayabilir. Çalışanlara yemekhane gibi bir alanda acil durumlar ile ilgili genel bilgi verilir. Tatbikat yapılmaz.	Acil durum ekipleri vardır ve eğitimlidirler. Yangınla mücadele ekipmanları yeteri kadar vardır. Acil durum aydınlatması bulunur. Tatbikatlar tesisin durduğu dönemlere göre planlanır ve gerçekleştirilir. Örneğin yangın tatbikatı itfaiyeden yetkililer tarafından yaptırılır. Tatbikatta yangın söndürme ekipmanının nasıl kullanılacağı gösterilir. Çalışanlar acil toplanma yerini bilirler.	Acil durum ekipleri vardır ve eğitimlidirler. Her vardiyada acil durum görevlileri panoda asılıdır. Acil eylem planları vardır. Tatbikatlar düzenli olarak ve gerçeğe özdeş gerçekleştirilir ve tekrarlanır. Çalışanlar kaçış yollarını ve toplanma alanını bilir. Acil durum ekipmanları kalitelidir ve periyodik olarak kontrol edilir.

APPENDIX B

ANALYSES

1. Total variance explained by the unsafe behaviors with eigenvalue >1in factor analysis

Total Variance Explained

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	20.802	33.551	33.551	20.535	33.121	33.121	12.912
2	4.553	7.344	40.895	4.306	6.945	40.065	12.012
3	3.906	6.299	47.194	3.641	5.872	45.938	9.617
4	2.875	4.638	51.832	2.629	4.241	50.179	8.643
5	2.602	4.196	56.028	2.342	3.777	53.956	7.038
6	2.266	3.655	59.683	1.999	3.224	57.181	11.931
7	2.190	3.532	63.215	1.916	3.090	60.271	6.468
8	1.666	2.686	65.902	1.426	2.301	62.571	6.142
9	1.471	2.372	68.274	1.207	1.947	64.518	6.365
10	1.336	2.155	70.429	1.032	1.665	66.183	7.557
11	1.224	1.973	72.403	.950	1.532	67.715	4.966
12	1.203	1.940	74.343	.887	1.431	69.146	1.476
13	1.096	1.767	76.110	.806	1.300	70.446	4.448
14	1.036	1.671	77.781	.725	1.169	71.615	1.995
15	.979	1.579	79.360				
16	.933	1.506	80.865				

2. Regression

2.1 Hierarchical Multiple Regression: Accident vs. Demographic Distribution, Safety Culture

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	weekly working hours, experience (years), age[b]	.	Enter
2	SC10, SC3, SC4, SC1, SC9, SC6, SC8, SC5, SC7, SC2[b]	.	Enter

a. Dependent Variable: Total number of accidents

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,136[a]	,018	-,031	1,696
2	,555[b]	,308	,128	1,560

a. Predictors: (Constant), weekly working hours, experience (years), age

b. Predictors: (Constant), weekly working hours, experience (years), age, SC10, SC3, SC4, SC1, SC9, SC6, SC8, SC5, SC7, SC2

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3,248	3	1,083	,376	,770[b]
	Residual	172,612	60	2,877		
	Total	175,859	63			
2	Regression	54,203	13	4,169	1,714	,087[c]
	Residual	121,657	50	2,433		
	Total	175,859	63			

a. Dependent Variable: Total number of accidents
b. Predictors: (Constant), weekly working hours, experience (years), age
c. Predictors: (Constant), weekly working hours, experience (years), age, SC10, SC3, SC4, SC1, SC9, SC6, SC8, SC5, SC7, SC2

2.2 Hierarchical Multiple Regression: Accident vs. Demographic Distribution and Leadership

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	weekly working hours, experience (years), age[b]	.	Enter
2	Leadership awareness and effort, Leadership coaching and caring[b]	.	Enter

a. Dependent Variable: Total number of accidents
b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,184[a]	,034	,013	1,376
2	,330[b]	,109	,076	1,331

a. Predictors: (Constant), weekly working hours, experience (years), age

b. Predictors: (Constant), weekly working hours, experience (years), age, Leadership awareness and effort, Leadership coaching and caring

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-3,242	1,972		-1,644	,102
	age	,019	,017	,113	1,103	,272
	experience (years)	-,023	,017	-,138	-1,351	,179
	weekly working hours	,067	,038	,149	1,753	,082
2	(Constant)	-1,430	1,990		-,719	,474
	age	,010	,017	,063	,621	,535
	experience (years)	-,011	,017	-,065	-,643	,521
	weekly working hours	,052	,037	,116	1,404	,163
	Leadership coaching and caring	,066	,267	,061	,246	,806
	Leadership awareness and effort	-,331	,242	-,339	-1,370	,173

a. Dependent Variable: Total number of accidents

Excluded Variables[a]

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics
						Tolerance
1	Leadership coaching and caring	-,259[b]	-3,064	,003	-,254	,933
	Leadership awareness and effort	-,281[b]	-3,368	,001	-,277	,940

a. Dependent Variable: Total number of accidents

b. Predictors in the Model: (Constant), weekly working hours, experience (years), age

2.3 Hierarchical Multiple Regression: Accident vs. Demographic Distribution, Unsafe Acts

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	weekly working hours, experience (years), age[b]	.	Enter
2	PPE relevant routine violation, Slips causing tripping jamming and falling, Exceptional violations due to production over safety approach, Equipment and material related perception errors, Absentmindedness and lapses in some tasks[b]	.	Enter

a. Dependent Variable: Total number of accidents

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,180[a]	,033	,010	1,405
2	,228[b]	,052	-,008	1,418

a. Predictors: (Constant), weekly working hours, experience (years), age
b. Predictors: (Constant), weekly working hours, experience (years), age, PPE relevant routine violation, Slips causing tripping jamming and falling, Exceptional violations due to production over safety approach, Equipment and material related perception errors, Absentmindedness and lapses in some tasks

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8,698	3	2,899	1,469	,226[b]
	Residual	258,635	131	1,974		
	Total	267,333	134			
2	Regression	13,937	8	1,742	,866	,547[c]
	Residual	253,396	126	2,011		
	Total	267,333	134			

a. Dependent Variable: Total number of accidents
b. Predictors: (Constant), weekly working hours, experience (years), age
c. Predictors: (Constant), weekly working hours, experience (years), age, PPE relevant routine violation, Slips causing tripping jamming and falling, Exceptional violations due to production over safety approach, Equipment and material related perception errors, Absentmindedness and lapses in some tasks

2.4 Hierarchical Multiple Regression: Unsafe Acts-Safety Culture

2.4.1 Equipment and material related perceptual errors- Safety Culture

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Weekly working hours, kaç yıldır bu tesiste çalışıyorsunuz, yaş, haftalık çalışma saati[b]	.	Enter
2	SC10, SC1, SC5, SC9, SC6, SC4, SC8, SC7, SC3, SC2[b]	.	Enter

a. Dependent Variable: Equipment and material related perception errors

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,232[a]	,054	-,011	,839
2	,541[b]	,292	,086	,798

a. Predictors: (Constant), Weekly working hours, kaç yıldır bu tesiste çalışıyorsunuz, yaş, haftalık çalışma saati

b. Predictors: (Constant), Weekly working hours, kaç yıldır bu tesiste çalışıyorsunuz, yaş, haftalık çalışma saati, SC10, SC1, SC5, SC9, SC6, SC4, SC8, SC7, SC3, SC2

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2,321	4	,580	,824	,515[b]
	Residual	40,842	58	,704		
	Total	43,163	62			
2	Regression	12,624	14	,902	1,417	,182[c]
	Residual	30,539	48	,636		
	Total	43,163	62			

a. Dependent Variable: Equipment and material related perception errors
b. Predictors: (Constant), Weekly working hours, kaç yıldır bu tesiste çalışıyorsunuz, yaş, haftalık çalışma saati
c. Predictors: (Constant), Weekly working hours, kaç yıldır bu tesiste çalışıyorsunuz, yaş, haftalık çalışma saati, SC10, SC1, SC5, SC9, SC6, SC4, SC8, SC7, SC3, SC2

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-1,134	1,792		-,633	,529
	yaş	-,001	,018	-,005	-,029	,977
	kaç yıldır bu tesiste çalışıyorsunuz	,008	,015	,083	,516	,608
	haftalık çalışma saati	,018	,061	,076	,288	,774
	Weekly working hours	,021	,034	,167	,611	,544
2	(Constant)	,214	2,255		,095	,925
	yaş	,008	,018	,075	,435	,665
	kaç yıldır bu tesiste çalışıyorsunuz	,008	,015	,083	,512	,611
	haftalık çalışma saati	,013	,067	,056	,191	,849
	Weekly working hours	,010	,038	,082	,268	,790
	SC1	,164	,126	,266	1,305	,198
	SC2	-,500	,232	-,630	-2,157	,036
	SC3	,031	,174	,043	,181	,857
	SC4	-,161	,168	-,237	-,959	,342
	SC5	,310	,193	,393	1,606	,115
	SC6	-,261	,177	-,314	-1,471	,148
	SC7	-,013	,195	-,017	-,068	,946
	SC8	,246	,174	,330	1,413	,164
	SC9	-,148	,173	-,184	-,854	,397
	SC10	,110	,136	,124	,812	,421

a. Dependent Variable: Equipment and material related perception errors

Excluded Variables[a]

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics
						Tolerance
1	SC1	-,043[b]	-,298	,767	-,039	,793
	SC2	-,390[b]	-2,768	,008	-,344	,737
	SC3	-,200[b]	-1,391	,170	-,181	,776
	SC4	-,293[b]	-2,168	,034	-,276	,840
	SC5	-,195[b]	-1,321	,192	-,172	,736
	SC6	-,256[b]	-1,858	,068	-,239	,827
	SC7	-,227[b]	-1,589	,118	-,206	,778
	SC8	-,054[b]	-,363	,718	-,048	,741
	SC9	-,216[b]	-1,483	,144	-,193	,751
	SC10	-,114[b]	-,887	,379	-,117	,990

a. Dependent Variable: Equipment and material related perception errors
b. Predictors in the Model: (Constant), Weekly working hours, kaç yıldır bu tesiste çalışıyorsunuz, yaş, haftalık çalışma saati

2.4.2 PPE relevant routine violations - Safety Culture

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	weekly working hours, experience (years), age[b]	.	Enter
2	SC10, SC1, SC4, SC6, SC9, SC5, SC3, SC8, SC7, SC2[b]	.	Enter

a. Dependent Variable: PPE relevant routine violation
b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,091[a]	,008	-,040	,846
2	,465[b]	,216	,020	,822

a. Predictors: (Constant), weekly working hours, experience (years), age

b. Predictors: (Constant), weekly working hours, experience (years), age, SC10, SC1, SC4, SC6, SC9, SC5, SC3, SC8, SC7, SC2

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	,370	3	,123	,172	,915[b]
	Residual	44,421	62	,716		
	Total	44,792	65			
2	Regression	9,690	13	,745	1,104	,377[c]
	Residual	35,102	52	,675		
	Total	44,792	65			

a. Dependent Variable: PPE relevant routine violation

b. Predictors: (Constant), weekly working hours, experience (years), age

c. Predictors: (Constant), weekly working hours, experience (years), age, SC10, SC1, SC4, SC6, SC9, SC5, SC3, SC8, SC7, SC2

2.4.3 Absentmindedness and lapses in some tasks- Safety Culture

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,090[a]	,008	-,041	,658
2	,583[b]	,340	,172	,587

a. Predictors: (Constant), weekly working hours, experience (years), age

b. Predictors: (Constant), weekly working hours, experience (years), age, SC10, SC1, SC4, SC6, SC9, SC5, SC8, SC3, SC7, SC2

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	,214	3	,071	,165	,920[b]
	Residual	26,446	61	,434		
	Total	26,661	64			
2	Regression	9,069	13	,698	2,022	,038[c]
	Residual	17,592	51	,345		
	Total	26,661	64			

a. Dependent Variable: Absentmindedness and lapses in some tasks
b. Predictors: (Constant), weekly working hours, experience (years), age
c. Predictors: (Constant), weekly working hours, experience (years), age, SC10, SC1, SC4, SC6, SC9, SC5, SC8, SC3, SC7, SC2

2.4.4 Exceptional violations due to production over safety approach - Safety Culture

Excluded Variables[a]

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics
						Tolerance
1	SC1	,144[b]	1,021	,311	,132	,820
	SC2	-,279[b]	-1,987	,052	-,250	,788
	SC3	-,154[b]	-1,104	,274	-,142	,835
	SC4	-,318[b]	-2,364	,021	-,294	,840
	SC5	-,151[b]	-1,020	,312	-,132	,748
	SC6	-,255[b]	-1,860	,068	-,235	,835
	SC7	-,113[b]	-,768	,446	-,099	,754
	SC8	-,007[b]	-,048	,962	-,006	,745
	SC9	-,256[b]	-1,761	,083	-,223	,749
	SC10	-,268[b]	-2,147	,036	-,269	,986

a. Dependent Variable: Exceptional violations due to production over safety approach
b. Predictors in the Model: (Constant), weekly working hours, experience (years), age

2.4.4 Slips causing tripping, jamming and falling - Safety Culture

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,173[a]	,030	-,021	,788
2	,579[b]	,335	,152	,718

a. Predictors: (Constant), weekly working hours, experience (years), age

b. Predictors: (Constant), weekly working hours, experience (years), age, SC10, SC1, SC4, SC6, SC9, SC5, SC3, SC7, SC8, SC2

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1,086	3	,362	,583	,629[b]
	Residual	35,381	57	,621		
	Total	36,466	60			
2	Regression	12,232	13	,941	1,825	,067[c]
	Residual	24,235	47	,516		
	Total	36,466	60			

a. Dependent Variable: Slips causing tripping jamming and falling
b. Predictors: (Constant), weekly working hours, experience (years), age
c. Predictors: (Constant), weekly working hours, experience (years), age, SC10, SC1, SC4, SC6, SC9, SC5, SC3, SC7, SC8, SC2

2.4 Hierarchical Multiple Regression: Unsafe Acts vs. Demographic Background and Leadership

2.4.1 Equipment and material related perceptual errors- Leadership

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	weekly working hours, experience (years), age[b]	.	Enter
2	Leadership awareness and effort, Leadership coaching and caring[b]	.	Enter

a. Dependent Variable: Equipment and material related perception errors

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,223[a]	,050	,034	,792
2	,246[b]	,060	,034	,792

a. Predictors: (Constant), weekly working hours, experience (years), age

b. Predictors: (Constant), weekly working hours, experience (years), age, Leadership awareness and effort, Leadership coaching and caring

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5,899	3	1,966	3,137	,027[b]
	Residual	112,211	179	,627		
	Total	118,109	182			
2	Regression	7,124	5	1,425	2,272	,049[c]
	Residual	110,985	177	,627		
	Total	118,109	182			

a. Dependent Variable: Equipment and material related perception errors

b. Predictors: (Constant), weekly working hours, experience (years), age

c. Predictors: (Constant), weekly working hours, experience (years), age, Leadership awareness and effort, Leadership coaching and caring

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-1,667	1,020		-1,634	,104
	age	-,007	,009	-,071	-,762	,447
	experience (years)	,001	,009	,014	,148	,883
	weekly working hours	,056	,020	,206	2,811	,005
2	(Constant)	-1,188	1,078		-1,101	,272
	age	-,009	,009	-,095	-1,001	,318
	experience (years)	,004	,009	,043	,452	,652
	weekly working hours	,052	,020	,190	2,555	,011
	Leadership coaching and caring	-,057	,051	-,087	-1,115	,266
	Leadership awareness and effort	-,005	,008	-,044	-,577	,565

a. Dependent Variable: Equipment and material related perception errors

2.4.2 PPE relevant routine violations - Leadership

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	weekly working hours, experience (years), age[b]	.	Enter
2	Leadership awareness and effort, Leadership coaching and caring[b]	.	Enter

a. Dependent Variable: Equipment and material related perception errors
b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,223[a]	,050	,034	,792
2	,246[b]	,060	,034	,792

a. Predictors: (Constant), weekly working hours, experience (years), age
b. Predictors: (Constant), weekly working hours, experience (years), age, Leadership awareness and effort, Leadership coaching and caring

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5,899	3	1,966	3,137	,027[b]
	Residual	112,211	179	,627		
	Total	118,109	182			
2	Regression	7,124	5	1,425	2,272	,049[c]
	Residual	110,985	177	,627		
	Total	118,109	182			

a. Dependent Variable: Equipment and material related perception errors
b. Predictors: (Constant), weekly working hours, experience (years), age
c. Predictors: (Constant), weekly working hours, experience (years), age, Leadership awareness and effort, Leadership coaching and caring

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-1,667	1,020		-1,634	,104
	age	-,007	,009	-,071	-,762	,447
	experience (years)	,001	,009	,014	,148	,883
	weekly working hours	,056	,020	,206	2,811	,005
2	(Constant)	-1,188	1,078		-1,101	,272
	age	-,009	,009	-,095	-1,001	,318
	experience (years)	,004	,009	,043	,452	,652
	weekly working hours	,052	,020	,190	2,555	,011
	Leadership coaching and caring	-,057	,051	-,087	-1,115	,266
	Leadership awareness and effort	-,005	,008	-,044	-,577	,565

a. Dependent Variable: Equipment and material related perception errors

2.4.3 Absentmindedness and lapses in some tasks- Leadership

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	weekly working hours, experience (years), age[b]	.	Enter
2	Leadership awareness and effort, Leadership coaching and caring[b]	.	Enter

a. Dependent Variable: Absentmindedness and lapses in some tasks
b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,125[a]	,016	-,001	,810
2	,205[b]	,042	,015	,804

a. Predictors: (Constant), weekly working hours, experience (years), age
b. Predictors: (Constant), weekly working hours, experience (years), age, Leadership awareness and effort, Leadership coaching and caring

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1,875	3	,625	,952	,417[b]
	Residual	117,475	179	,656		
	Total	119,350	182			
2	Regression	5,003	5	1,001	1,549	,177[c]
	Residual	114,347	177	,646		
	Total	119,350	182			

a. Dependent Variable: Absentmindedness and lapses in some tasks
b. Predictors: (Constant), weekly working hours, experience (years), age
c. Predictors: (Constant), weekly working hours, experience (years), age, Leadership awareness and effort, Leadership coaching and caring

2.4.4 Exceptional violations due to production over safety approach - Leadership

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	weekly working hours, experience (years), age[b]	.	Enter
2	Leadership awareness and effort, Leadership coaching and caring[b]	.	Enter

a. Dependent Variable: Exceptional violations due to production over safety approach
b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,218[a]	,048	,031	,915
2	,323[b]	,104	,079	,892

a. Predictors: (Constant), weekly working hours, experience (years), age

b. Predictors: (Constant), weekly working hours, experience (years), age, Leadership awareness and effort, Leadership coaching and caring

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7,407	3	2,469	2,950	,034[b]
	Residual	148,125	177	,837		
	Total	155,532	180			
2	Regression	16,227	5	3,245	4,077	,002[c]
	Residual	139,305	175	,796		
	Total	155,532	180			

a. Dependent Variable: Exceptional violations due to production over safety approach

b. Predictors: (Constant), weekly working hours, experience (years), age

c. Predictors: (Constant), weekly working hours, experience (years), age, Leadership awareness and effort, Leadership coaching and caring

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-1,446	1,180		-1,225	,222
	age	,000	,011	-,001	-,010	,992
	experience (years)	-,013	,011	-,110	-1,178	,240
	weekly working hours	,056	,023	,179	2,421	,017
2	(Constant)	-,144	1,216		-,118	,906
	age	-,006	,011	-,056	-,603	,548
	experience (years)	-,003	,011	-,029	-,308	,758
	weekly working hours	,045	,023	,143	1,955	,052
	Leadership coaching and caring	-,181	,058	-,240	-3,128	,002
	Leadership awareness and effort	-,004	,010	-,031	-,425	,671

a. Dependent Variable: Exceptional violations due to production over safety approach

2.4.4 Slips causing tripping, jamming and falling - Leadership

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	weekly working hours, experience (years), age[b]	.	Enter
2	Leadership awareness and effort, Leadership coaching and caring[b]	.	Enter

a. Dependent Variable: Exceptional violations due to production over safety approach

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,218[a]	,048	,031	,915
2	,323[b]	,104	,079	,892

a. Predictors: (Constant), weekly working hours, experience (years), age

b. Predictors: (Constant), weekly working hours, experience (years), age, Leadership awareness and effort, Leadership coaching and caring

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7,407	3	2,469	2,950	,034[b]
	Residual	148,125	177	,837		
	Total	155,532	180			
2	Regression	16,227	5	3,245	4,077	,002[c]
	Residual	139,305	175	,796		
	Total	155,532	180			

a. Dependent Variable: Exceptional violations due to production over safety approach

b. Predictors: (Constant), weekly working hours, experience (years), age

c. Predictors: (Constant), weekly working hours, experience (years), age, Leadership awareness and effort, Leadership coaching and caring

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
2	(Constant)	-,144	1,216		-,118	,906
	age	-,006	,011	-,056	-,603	,548
	experience (years)	-,003	,011	-,029	-,308	,758
	weekly working hours	,045	,023	,143	1,955	,052
	Leadership coaching and caring	-,181	,058	-,240	-3,128	,002
	Leadership awareness and effort	-,004	,010	-,031	-,425	,671

a. Dependent Variable: Exceptional violations due to production over safety approach

3. Mediation

3.1 Indirect effect of safety culture on accidents over unsafe behaviors

3.1.1

Dependent, Independent, and Proposed Mediator Variables:
DV = ACC_TOT
IV = SC1
MEDS = BEH_1
BEH_2
BEH_3
BEH_4
BEH_5

Sample size
83

IV to Mediators (a paths)

	Coeff	se	t	p
BEH_1	-,0232	,0675	-,3433	,7322
BEH_2	,1255	,0695	1,8048	,0748
BEH_3	-,0587	,0515	-1,1394	,2579
BEH_4	,1068	,0866	1,2329	,2212
BEH_5	-,1116	,0603	-1,8513	,0678

Direct Effects of Mediators on DV (b paths)

	Coeff	se	t	p
BEH_1	,2255	,3696	,6101	,5436
BEH_2	-,1771	,2930	-,6046	,5472
BEH_3	-,3146	,5243	-,6000	,5503
BEH_4	,1805	,2916	,6190	,5377
BEH_5	-,0101	,3896	-,0260	,9793

Total Effect of IV on DV (c path)

	Coeff	se	t	p
SC1	-,1764	,1442	-1,2230	,2249

Direct Effect of IV on DV (c' path)

	Coeff	se	t	p
SC1	-,1878	,1644	-1,1427	,2568

Model Summary for DV Model

R-sq	Adj R-sq	F	df1	df2	p
,0384	-,0375	,5064	6,0000	76,0000	,8017

****

BOOTSTRAP RESULTS FOR INDIRECT EFFECTS

Indirect Effects of IV on DV through Proposed Mediators (ab paths)

	Data	Boot	Bias	SE
TOTAL	,0114	,0135	,0021	,0982
BEH_1	-,0052	-,0057	-,0005	,0354
BEH_2	-,0222	-,0197	,0026	,0380
BEH_3	,0185	,0192	,0007	,0416
BEH_4	,0193	,0157	-,0036	,0517
BEH_5	,0011	,0039	,0028	,0394

Bias Corrected Confidence Intervals

	Lower	Upper
TOTAL	-,2051	,1966
BEH_1	-,1465	,0325
BEH_2	-,1451	,0239
BEH_3	-,0295	,1670
BEH_4	-,0421	,1816
BEH_5	-,0783	,0873

****

Level of Confidence for Confidence Intervals:
95

Number of Bootstrap Resamples:
5000

3.1.2

Dependent, Independent, and Proposed Mediator Variables:
DV = ACC_TOT
IV = SC2
MEDS = BEH_1
BEH_2
BEH_3
BEH_4
BEH_5

Sample size
83

IV to Mediators (a paths)

	Coeff	se	t	p
BEH_1	-,2018	,0864	-2,3355	,0220
BEH_2	-,0743	,0933	-,7967	,4280
BEH_3	-,1297	,0670	-1,9346	,0565

BEH_4	-,1375	,1144	-1,2015	,2331
BEH_5	-,2352	,0770	-3,0552	,0030

Direct Effects of Mediators on DV (b paths)

	Coeff	se	t	p
BEH_1	,3754	,3682	1,0196	,3111
BEH_2	-,2892	,2818	-1,0266	,3079
BEH_3	-,2338	,5178	-,4515	,6529
BEH_4	,0564	,2800	,2015	,8408
BEH_5	,1563	,3951	,3957	,6934

Total Effect of IV on DV (c path)

	Coeff	se	t	p
SC2	,1705	,1913	,8911	,3755

Direct Effect of IV on DV (c' path)

	Coeff	se	t	p
SC2	,2389	,2085	1,1459	,2554

Model Summary for DV Model

R-sq	Adj R-sq	F	df1	df2	p
,0385	-,0374	,5076	6,0000	76,0000	,8008

****

BOOTSTRAP RESULTS FOR INDIRECT EFFECTS

Indirect Effects of IV on DV through Proposed Mediators (ab paths)

	Data	Boot	Bias	SE
TOTAL	-,0685	-,0640	,0044	,0835
BEH_1	-,0757	-,0758	,0000	,0806
BEH_2	,0215	,0230	,0015	,0461
BEH_3	,0303	,0290	-,0013	,0723
BEH_4	-,0078	-,0043	,0035	,0722
BEH_5	-,0368	-,0360	,0008	,0900

Bias Corrected Confidence Intervals

	Lower	Upper
TOTAL	-,3031	,0593
BEH_1	-,3667	,0153
BEH_2	-,0175	,2155
BEH_3	-,0883	,2099
BEH_4	-,1932	,1211
BEH_5	-,2854	,0962

****

Level of Confidence for Confidence Intervals:
95

Number of Bootstrap Resamples:
5000

3.1.3

Dependent, Independent, and Proposed Mediator Variables:
DV = ACC_TOT
IV = SC3
MEDS = BEH_1
BEH_2
BEH_3
BEH_4
BEH_5

Sample size
83

IV to Mediators (a paths)

	Coeff	se	t	p
BEH_1	-,0844	,0830	-1,0163	,3125
BEH_2	,1351	,0864	1,5639	,1217
BEH_3	-,1225	,0627	-1,9522	,0544
BEH_4	-,0264	,1080	-,2448	,8072
BEH_5	-,1587	,0740	-2,1432	,0351

Direct Effects of Mediators on DV (b paths)

	Coeff	se	t	p
BEH_1	,2244	,3666	,6122	,5423
BEH_2	-,1442	,2954	-,4883	,6267
BEH_3	-,3503	,5248	-,6675	,5064
BEH_4	,1372	,2808	,4886	,6265
BEH_5	,0054	,3857	,0140	,9889

Total Effect of IV on DV (c path)

	Coeff	se	t	p
SC3	-,2711	,1774	-1,5282	,1304

Direct Effect of IV on DV (c' path)

	Coeff	se	t	p
SC3	-,2711	,1995	-1,3594	,1780

Model Summary for DV Model

R-sq	Adj R-sq	F	df1	df2	p

,0451 -,0302 ,5988 6,0000 76,0000 ,7304

****

BOOTSTRAP RESULTS FOR INDIRECT EFFECTS

Indirect Effects of IV on DV through Proposed Mediators (ab paths)

	Data	Boot	Bias	SE
TOTAL	,0000	-,0063	-,0063	,1060
BEH_1	-,0189	-,0218	-,0029	,0472
BEH_2	-,0195	-,0197	-,0002	,0450
BEH_3	,0429	,0436	,0007	,0684
BEH_4	-,0036	-,0115	-,0079	,0433
BEH_5	-,0009	,0030	,0039	,0544

Bias Corrected Confidence Intervals

	Lower	Upper
TOTAL	-,2633	,1737
BEH_1	-,2234	,0189
BEH_2	-,1648	,0345
BEH_3	-,0523	,2359
BEH_4	-,1270	,0623
BEH_5	-,1211	,1091

****

Level of Confidence for Confidence Intervals:
95

Number of Bootstrap Resamples:
5000

3.1.4

Dependent, Independent, and Proposed Mediator Variables:
DV = ACC_TOT
IV = SC4
MEDS = BEH_1
BEH_2
BEH_3
BEH_4
BEH_5

Sample size
83

IV to Mediators (a paths)

	Coeff	se	t	p
BEH_1	-,1274	,0762	-1,6730	,0982
BEH_2	-,0804	,0808	-,9948	,3228
BEH_3	-,1076	,0583	-1,8451	,0687
BEH_4	-,1565	,0987	-1,5853	,1168
BEH_5	-,1952	,0671	-2,9080	,0047

Direct Effects of Mediators on DV (b paths)

	Coeff	se	t	p
BEH_1	,3128	,3643	,8587	,3932
BEH_2	-,2696	,2822	-,9555	,3423
BEH_3	-,2437	,5200	-,4687	,6406
BEH_4	,0923	,2801	,3294	,7427
BEH_5	,1387	,3971	,3493	,7278

Total Effect of IV on DV (c path)

	Coeff	se	t	p
SC4	,1285	,1662	,7732	,4416

Direct Effect of IV on DV (c' path)

	Coeff	se	t	p
SC4	,1620	,1785	,9079	,3668

Model Summary for DV Model

R-sq	Adj R-sq	F	df1	df2	p
,0324	-,0440	,4243	6,0000	76,0000	,8606

****

BOOTSTRAP RESULTS FOR INDIRECT EFFECTS

Indirect Effects of IV on DV through Proposed Mediators (ab paths)

	Data	Boot	Bias	SE
TOTAL	-,0335	-,0302	,0033	,0632
BEH_1	-,0399	-,0410	-,0011	,0519
BEH_2	,0217	,0237	,0020	,0389
BEH_3	,0262	,0226	-,0036	,0653
BEH_4	-,0144	-,0085	,0059	,0715
BEH_5	-,0271	-,0270	,0000	,0741

Bias Corrected Confidence Intervals

	Lower	Upper
TOTAL	-,2047	,0665
BEH_1	-,2152	,0155
BEH_2	-,0124	,1818

BEH_3	-,0756	,2076
BEH_4	-,2036	,1019
BEH_5	-,2560	,0709

****

Level of Confidence for Confidence Intervals:
95

Number of Bootstrap Resamples:
5000

3.1.5

Dependent, Independent, and Proposed Mediator Variables:
DV = ACC_TOT
IV = SC5
MEDS = BEH_1
BEH_2
BEH_3
BEH_4
BEH_5

Sample size
83

IV to Mediators (a paths)

	Coeff	se	t	p
BEH_1	-,0732	,0844	-,8677	,3881
BEH_2	-,0703	,0886	-,7931	,4300
BEH_3	-,0336	,0650	-,5175	,6062
BEH_4	-,0002	,1096	-,0014	,9989
BEH_5	-,1049	,0763	-1,3744	,1731

Direct Effects of Mediators on DV (b paths)

	Coeff	se	t	p
BEH_1	,3306	,3645	,9071	,3672
BEH_2	-,2532	,2823	-,8969	,3726
BEH_3	-,2500	,5193	-,4813	,6317
BEH_4	,0559	,2808	,1992	,8427
BEH_5	,1149	,3901	,2945	,7692

Total Effect of IV on DV (c path)

	Coeff	se	t	p
SC5	,1845	,1814	1,0174	,3120

Direct Effect of IV on DV (c' path)

	Coeff	se	t	p
SC5	,1946	,1892	1,0288	,3068

Model Summary for DV Model

R-sq	Adj R-sq	F	df1	df2	p
,0354	-,0408	,4642	6,0000	76,0000	,8327

****

BOOTSTRAP RESULTS FOR INDIRECT EFFECTS

Indirect Effects of IV on DV through Proposed Mediators (ab paths)

	Data	Boot	Bias	SE
TOTAL	-,0101	-,0217	-,0116	,0705
BEH_1	-,0242	-,0255	-,0013	,0503
BEH_2	,0178	,0170	-,0008	,0391
BEH_3	,0084	,0073	-,0011	,0405
BEH_4	,0000	-,0029	-,0029	,0496
BEH_5	-,0120	-,0175	-,0055	,0510

Bias Corrected Confidence Intervals

	Lower	Upper
TOTAL	-,1448	,1327
BEH_1	-,2255	,0213
BEH_2	-,0168	,1902
BEH_3	-,0460	,1339
BEH_4	-,1140	,1078
BEH_5	-,1871	,0475

****

Level of Confidence for Confidence Intervals:
95

Number of Bootstrap Resamples:
5000

3.1.6

Dependent, Independent, and Proposed Mediator Variables:
DV = ACC_TOT
IV = SC6
MEDS = BEH_1

BEH_2
BEH_3
BEH_4
BEH_5

Sample size
83

IV to Mediators (a paths)

	Coeff	se	t	p
BEH_1	-,1097	,0908	-1,2079	,2306
BEH_2	,0305	,0960	,3175	,7516
BEH_3	-,1677	,0679	-2,4703	,0156
BEH_4	-,1407	,1174	-1,1982	,2343
BEH_5	-,2103	,0801	-2,6263	,0103

Direct Effects of Mediators on DV (b paths)

	Coeff	se	t	p
BEH_1	,3038	,3664	,8291	,4096
BEH_2	-,2669	,2881	-,9265	,3571
BEH_3	-,2250	,5273	-,4268	,6707
BEH_4	,0843	,2815	,2996	,7653
BEH_5	,0521	,3918	,1329	,8946

Total Effect of IV on DV (c path)

	Coeff	se	t	p
SC6	-,0429	,1972	-,2173	,8285

Direct Effect of IV on DV (c' path)

	Coeff	se	t	p
SC6	-,0163	,2144	-,0761	,9395

Model Summary for DV Model

R-sq	Adj R-sq	F	df1	df2	p
,0220	-,0552	,2849	6,0000	76,0000	,9424

****

BOOTSTRAP RESULTS FOR INDIRECT EFFECTS

Indirect Effects of IV on DV through Proposed Mediators (ab paths)

	Data	Boot	Bias	SE
TOTAL	-,0265	-,0335	-,0069	,0975
BEH_1	-,0333	-,0419	-,0086	,0757
BEH_2	-,0081	-,0091	-,0010	,0417
BEH_3	,0377	,0381	,0004	,0945

BEH_4	-,0119	-,0119	,0000	,0812
BEH_5	-,0110	-,0086	,0023	,0801

Bias Corrected Confidence Intervals

	Lower	Upper
TOTAL	-,2549	,1420
BEH_1	-,3225	,0321
BEH_2	-,1446	,0398
BEH_3	-,1203	,2698
BEH_4	-,2479	,1049
BEH_5	-,2243	,1186

****

Level of Confidence for Confidence Intervals:
95

Number of Bootstrap Resamples:
5000

3.1.7

Dependent, Independent, and Proposed Mediator Variables:
DV = ACC_TOT
IV = SC7
MEDS = BEH_1
BEH_2
BEH_3
BEH_4
BEH_5

Sample size
83

IV to Mediators (a paths)

	Coeff	se	t	p
BEH_1	-,0527	,0939	-,5610	,5763
BEH_2	,0554	,0985	,5624	,5754
BEH_3	-,0754	,0718	-1,0495	,2971
BEH_4	,0078	,1217	,0638	,9493
BEH_5	-,1114	,0848	-1,3144	,1924

Direct Effects of Mediators on DV (b paths)

	Coeff	se	t	p
BEH_1	,3453	,3631	,9511	,3446
BEH_2	-,3186	,2826	-1,1273	,2632

BEH_3	-,1609	,5178	-,3108	,7568
BEH_4	,0436	,2797	,1559	,8765
BEH_5	,0957	,3852	,2485	,8044

Total Effect of IV on DV (c path)

	Coeff	se	t	p
SC7	,2482	,2007	1,2365	,2199

Direct Effect of IV on DV (c' path)

	Coeff	se	t	p
SC7	,2822	,2097	1,3460	,1823

Model Summary for DV Model

R-sq	Adj R-sq	F	df1	df2	p
,0447	-,0307	,5926	6,0000	76,0000	,7353

****

BOOTSTRAP RESULTS FOR INDIRECT EFFECTS

Indirect Effects of IV on DV through Proposed Mediators (ab paths)

	Data	Boot	Bias	SE
TOTAL	-,0340	-,0301	,0040	,1120
BEH_1	-,0182	-,0294	-,0113	,0745
BEH_2	-,0177	-,0136	,0040	,0414
BEH_3	,0121	,0145	,0023	,0586
BEH_4	,0003	,0064	,0061	,0525
BEH_5	-,0107	-,0079	,0028	,0531

Bias Corrected Confidence Intervals

	Lower	Upper
TOTAL	-,2744	,1810
BEH_1	-,2837	,0567
BEH_2	-,1825	,0225
BEH_3	-,0688	,1743
BEH_4	-,1125	,1090
BEH_5	-,2141	,0487

****

Level of Confidence for Confidence Intervals:
95

Number of Bootstrap Resamples:
5000

3.1.8
Dependent, Independent, and Proposed Mediator Variables:
DV = ACC_TOT
IV = SC8
MEDS = BEH_1
BEH_2
BEH_3
BEH_4
BEH_5

Sample size
83

IV to Mediators (a paths)

	Coeff	se	t	p
BEH_1	-,0003	,0863	-,0033	,9974
BEH_2	,1236	,0895	1,3810	,1711
BEH_3	-,1066	,0652	-1,6341	,1061
BEH_4	,0763	,1113	,6858	,4948
BEH_5	-,1095	,0776	-1,4106	,1622

Direct Effects of Mediators on DV (b paths)

	Coeff	se	t	p
BEH_1	,2790	,3646	,7652	,4465
BEH_2	-,2059	,2892	-,7121	,4786
BEH_3	-,3497	,5347	-,6539	,5151
BEH_4	,1419	,2855	,4971	,6206
BEH_5	,0417	,3863	,1080	,9142

Total Effect of IV on DV (c path)

	Coeff	se	t	p
SC8	-,1855	,1847	-1,0045	,3181

Direct Effect of IV on DV (c' path)

	Coeff	se	t	p
SC8	-,2035	,2029	-1,0030	,3190

Model Summary for DV Model

R-sq	Adj R-sq	F	df1	df2	p
,0347	-,0415	,4553	6,0000	76,0000	,8391

****

BOOTSTRAP RESULTS FOR INDIRECT EFFECTS

Indirect Effects of IV on DV through Proposed Mediators (ab paths)

	Data	Boot	Bias	SE
TOTAL	,0180	,0093	-,0087	,1230
BEH_1	-,0001	-,0004	-,0003	,0469
BEH_2	-,0254	-,0250	,0004	,0472
BEH_3	,0373	,0389	,0016	,0612
BEH_4	,0108	-,0003	-,0112	,0517
BEH_5	-,0046	-,0038	,0007	,0407

Bias Corrected Confidence Intervals

	Lower	Upper
TOTAL	-,2873	,2219
BEH_1	-,1024	,1010
BEH_2	-,1968	,0263
BEH_3	-,0452	,2128
BEH_4	-,0508	,1823
BEH_5	-,1229	,0594

****

Level of Confidence for Confidence Intervals:
95

Number of Bootstrap Resamples:
5000

3.1.9

Dependent, Independent, and Proposed Mediator Variables:
DV = ACC_TOT
IV = SC9
MEDS = BEH_1
BEH_2
BEH_3
BEH_4
BEH_5

Sample size
83

IV to Mediators (a paths)

	Coeff	se	t	p
BEH_1	-,1136	,0899	-1,2639	,2099
BEH_2	,0104	,0952	,1094	,9132
BEH_3	-,1300	,0682	-1,9061	,0602
BEH_4	-,1185	,1167	-1,0160	,3127
BEH_5	-,1539	,0809	-1,9032	,0606

Direct Effects of Mediators on DV (b paths)

	Coeff	se	t	p
BEH_1	,3191	,3666	,8703	,3869
BEH_2	-,2900	,2858	-1,0145	,3135
BEH_3	-,1908	,5243	-,3639	,7170
BEH_4	,0793	,2811	,2821	,7786
BEH_5	,0699	,3889	,1797	,8579

Total Effect of IV on DV (c path)

	Coeff	se	t	p
SC9	,0693	,1953	,3548	,7236

Direct Effect of IV on DV (c' path)

	Coeff	se	t	p
SC9	,1039	,2065	,5033	,6162

Model Summary for DV Model

R-sq	Adj R-sq	F	df1	df2	p
,0252	-,0518	,3270	6,0000	76,0000	,9208

****

BOOTSTRAP RESULTS FOR INDIRECT EFFECTS

Indirect Effects of IV on DV through Proposed Mediators (ab paths)

	Data	Boot	Bias	SE
TOTAL	-,0346	-,0354	-,0008	,0856
BEH_1	-,0362	-,0486	-,0123	,0739
BEH_2	-,0030	-,0003	,0027	,0372
BEH_3	,0248	,0238	-,0010	,0762
BEH_4	-,0094	-,0001	,0093	,0622
BEH_5	-,0108	-,0101	,0006	,0534

Bias Corrected Confidence Intervals

	Lower	Upper
TOTAL	-,2331	,1243
BEH_1	-,3159	,0220
BEH_2	-,1112	,0485
BEH_3	-,1212	,1906
BEH_4	-,1801	,0813
BEH_5	-,1635	,0723

****

Level of Confidence for Confidence Intervals:
95

Number of Bootstrap Resamples:
5000

3.1.10

Dependent, Independent, and Proposed Mediator Variables:
DV = ACC_TOT
IV = SC10
MEDS = BEH_1
BEH_2
BEH_3
BEH_4
BEH_5

Sample size
83

IV to Mediators (a paths)

	Coeff	se	t	p
BEH_1	-,0168	,1022	-,1647	,8696
BEH_2	-,0049	,1072	-,0456	,9637
BEH_3	-,0729	,0781	-,9335	,3533
BEH_4	-,1751	,1307	-1,3394	,1842
BEH_5	-,2074	,0901	-2,3007	,0240

Direct Effects of Mediators on DV (b paths)

	Coeff	se	t	p
BEH_1	,2302	,3660	,6289	,5313
BEH_2	-,2783	,2804	-,9924	,3241
BEH_3	-,3058	,5199	-,5882	,5582
BEH_4	,1492	,2823	,5286	,5986
BEH_5	,2012	,3988	,5046	,6153

Total Effect of IV on DV (c path)

	Coeff	se	t	p
SC10	,2694	,2180	1,2358	,2201

Direct Effect of IV on DV (c' path)

	Coeff	se	t	p
SC10	,3175	,2349	1,3513	,1806

Model Summary for DV Model

R-sq	Adj R-sq	F	df1	df2	p
,0449	-,0305	,5950	6,0000	76,0000	,7334

****

BOOTSTRAP RESULTS FOR INDIRECT EFFECTS

Indirect Effects of IV on DV through Proposed Mediators (ab paths)

	Data	Boot	Bias	SE
TOTAL	-,0481	-,0474	,0007	,0995
BEH_1	-,0039	-,0147	-,0108	,0585
BEH_2	,0014	,0040	,0026	,0375
BEH_3	,0223	,0205	-,0018	,0602
BEH_4	-,0261	-,0184	,0077	,0752
BEH_5	-,0417	-,0388	,0029	,0922

Bias Corrected Confidence Intervals

	Lower	Upper
TOTAL	-,2712	,1464
BEH_1	-,1589	,0936
BEH_2	-,0623	,1050
BEH_3	-,0419	,2352
BEH_4	-,2652	,0659
BEH_5	-,3490	,0757

****

Level of Confidence for Confidence Intervals:
95

Number of Bootstrap Resamples:
5000

3.2 Indirect effect of leadership factors on accidents over unsafe behaviors

3.2.1 Leadership coaching and caring on exceptional violations due to production over safety approach

Dependent, Independent, and Proposed Mediator Variables:
DV = ACC_TOT
IV = LE_1
MEDS = BEH_4

Sample size
173

IV to Mediators (a paths)

Coeff se t p

BEH_4	-,1299	,0562	-2,3119	,0220

Direct Effects of Mediators on DV (b paths)

	Coeff	se	t	p
BEH_4	,2287	,1133	2,0177	,0452

Total Effect of IV on DV (c path)

	Coeff	se	t	p
LE_1	-,2296	,0840	-2,7341	,0069

Direct Effect of IV on DV (c' path)

	Coeff	se	t	p
LE_1	-,1999	,0845	-2,3651	,0192

Model Summary for DV Model

R-sq	Adj R-sq	F	df1	df2	p
,0643	,0533	5,8403	2,0000	170,0000	,0035

****

BOOTSTRAP RESULTS FOR INDIRECT EFFECTS

Indirect Effects of IV on DV through Proposed Mediators (ab paths)

	Data	Boot	Bias	SE
TOTAL	-,0297	-,0322	-,0025	,0314
BEH_4	-,0297	-,0322	-,0025	,0314

Bias Corrected Confidence Intervals

	Lower	Upper
TOTAL	-,1256	,0061
BEH_4	-,1256	,0061

****

Level of Confidence for Confidence Intervals:
95

Number of Bootstrap Resamples:
5000

CURRICULUM VITAE

Esin PEKPAK FINDIKÇIOĞLU

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EDUCATION

Degree	Institution	Graduation	GPA
MS	METU Mining Engineering	2009	3.63
BS*	METU Mining Engineering,	2006	3.5
High School	Atatürk Anatolian High School	2001	4.78 of 5.00

***** First student in rank

EXPERIENCES

Year	Place	Enrollment
2013 - Present	Minis. of Labor and Social Security	Occpational HSE
2008 - 2013	METU Mining Engineering	ResearchAssistant
2004 Summer	Şişecam Kum İşleme Tesisi	Trainee
2003 Summer	Eti Maden Kırka Boraks İşletmeleri	Trainee

FOREIGN LANGUAGES

Advanced English, Fluent Spanish

PUBLICATIONS

1- Pekpak E., Kaymaz İ. Ö., Çınar K., Karaosmanoğlu V. Ö., 6331 Sayılı İş Sağlığı ve Güvenliği (İSG) Kanunu'nun Proaktif Yaklaşımının Haddon Matrisi ile Değerlendirilmesi, 19. Dünya İş Sağlığı ve Güvenliği Kongresi, May 5-7, 2014.

2- Pekpak E., Özbayoğlu G., Yılmaz A., The effect of synthesis and doping procedures on thermoluminescent response of lithium tetraborate, Journal of Alloys and Compounds, 2466-2472, 2011.
3- Pekpak E., Özbayoğlu G., Yılmaz A., An overview on preparation and TL Characterization of lithium borates for dosimetric use, the open mineral Processing Journal, 14-24, 2010.
4- Kılıç M., Pekpak E., Lüle G. M., Absorption of rhodamine-B from aqueous solutions with ultrafine kaolinite, 12. ınternational mineral processing Symposium, October 6-8, 2010 .
5- Pekpak E., Yoncacı S., Kılıç M.G., An overview of underground coal gasification and its applicability for Turkish lignite, 12th International Symposium on Environmental Issues and Waste Management in Energy and Mineral Production, Prague Czech Republic ,398-407, May 24-26, 2010.
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8- Özbayoğlu G., Depci T., Ataman N., Pekpak E., Coal Flotability by Microwave Treatment, 11.th International Mineral Processing Symposium, Antalya, Turkiye, 693-699,2008

HOBBIES

Yoga, Reflexology, Poi spinning