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Saygılarımızla,

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From the Editor

Dear Readers;
We are greatly honored to meet you with the new issue of the Hittite Occupational Health and Safety Journal. The progress of our magazine in its field depends on the support and favor of you, our readers. In order to enhance the quality of our journal and ensure its continuity, we have added experts in their fields to our editorial board.
In each issue of our magazine, we aim to publish articles on various fields of Occupational Health and Safety. In this issue of the journal, we are sharing 5 original research articles that we believe will contribute to the literature.
We wish all our readers enjoyable and productive reading.
Sincerely,

Prof. Dr. Dursun Ali KÖSE
On behalf of the HJOHS Editorial Board

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Analysis of Occupational Health and Safety in Welded Manufacturing

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Büşra GÜNAYDIN: Conceptualization, investigation, resources, review.

Analysis of Occupational Health and Safety in Welded Manufacturing

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Abstract

In this study, occupational health and safety analysis of workers performing welded manufacturing in an organized industrial zone was conducted. The aim of the study is to determine the relationship between the characteristics of the workers and occupational health and safety within the framework of the risks that may occur in welded manufacturing works. According to the results to be determined here, necessary improvements can be made and a healthier and safer working environment can be provided in welded manufacturing works. In this context, a survey including general demographic characteristics, occupational accidents-occupational diseases and occupational health and safety was applied to workers in welded manufacturing works. According to the survey results, it was seen that approximately half of the welding workers had an occupational accident and approximately one third had an occupational disease. It was determined that the rate of occupational accidents and occupational diseases was lower in workers who received welding and occupational health and safety training. The full use of personal protective equipment is not at the desired levels. The rate of occupational accidents and occupational diseases was low in welding workers who used this equipment fully. The most prominent occupational diseases are lumbar-cervical disc herniations, hearing and eye diseases. Long-term welding works and non-ergonomic working conditions were determined as the causes of back and neck disorders.

Keywords: Welding, Welded Manufacturing, Occupational Health and Safety.

INTRODUCTION

Methods such as welding, casting, plastic deformation, machining, powder metallurgy are used to shape metallic materials. Welding is the most preferred method in the shaping of metallic materials by joining, cutting, repair and filling processes. Welding methods are divided into two groups as fusion welding methods and non-fusion (solid state) welding methods. Covered electrode, gas metal arc, submerged arc, plasma arc, laser, electroslag, electron beam, oxy-gas welding are examples of fusion welding methods. Resistance, friction, friction stir, diffusion, explosion, ultrasonic welding methods are examples of solid state welding methods. In these methods, metallic materials are joined by using heat or pressure or both [1- 5]. Welding process is used especially in manufacturing from metallic materials. Main welding manufacturing applications include; steel and aluminum constructions, pressure vessels and equipment, pipelines and systems, boilers, ships and marine vehicles, road vehicles, railways and railway vehicles, space and aviation, power plants, petrochemical facilities, machinery manufacturing industry, fuel storage facilities [2].

Figure 1. Welded manufacturing [2]

There are risks of various occupational accidents and occupational diseases when necessary precautions are not taken in welded manufacturing works. Welding workers can be exposed to various occupational accidents as a result of electric shock, fire-explosion, falling from height, splashes, and can catch various occupational diseases due to electromagnetic fields, rays, welding gas-fume, noise, vibration, ergonomic difficulties [1-2, 5-8]. Therefore, for a healthy and safe work, collective protection measures and personal protection measures are necessary to eliminate and reduce the risk at its source.

There are some studies on occupational safety in welded manufacturing. Okumuş et al. examined the effects of fatigue on the occupational health and safety and performance of shipyard welding workers in their study. For this purpose, data were collected through observations and surveys in the shipyard. The results showed that the most disturbed body parts in the examined welding positions are the eyes, knees, neck and waist. The age of the welders is an important parameter of the most affected body part [9]. Sriram et al. investigated the effect of voltage, one of the welding parameters, on the neurotoxic potential of welding fumes. As a result of the study, they reported that modulating the voltage parameter could potentially help reduce manganese-induced neurotoxicity during welding [10]. Antonini et al. studied the development of an experimental animal model to study the potential neurotoxic effects associated with welding fume inhalation. It was reported that with the development of this system, possible mechanisms by which welding fume may affect the central nervous system could be studied [6]. Özalp et al. examined the risks caused by electricity in welding work in terms of occupational health and safety. It was stated that in welding work, electrical work accidents occur due to reasons such as uncontrolled and careless work, unsafe production methods, irregular work environment, conscious use of machinery and equipment, disregard for risks, inadequate training, lack of experience, excessive self-confidence, fatigue and inadequate use of personal protective equipment [11]. Akçakale, in his study on occupational health and safety in oxy-gas welding, reported that due to the use of flammable and explosive gases in this welding method, work accidents in the form of fire and explosion, and various occupational diseases due to gas, steam and dust in the welding environment, may occur and necessary safety measures should be taken against these [4]. Teker and Gençdoğan, in their study on occupational accidents and safety measures in the welding profession in our country, examined occupational accidents in welding and oxy-gas metal cutting works between 2015-2018 and reported

that there was a 66.4% increase in occupational accidents during this period, therefore, the importance of implementing the necessary occupational safety measures [12]. Bayar and Arabacı determined the causes and levels of thermal comfort exposure in fifteen different workplaces in the welding sector and reported measures to reduce and prevent this exposure [13]. Aydın et al. conducted an occupational health and safety risk assessment in the welding workshop of a company that produces tractor cabins and agricultural machinery, measures were determined to reduce the risks, and all high risks identified in the welding workshop were reduced to acceptable levels with the work carried out [14].

In this study, a survey was conducted on workers in welded manufacturing in a medium-sized organized industrial zone to determine their general demographic characteristics, occupational accidents and diseases they have experienced, and their possession and application of occupational safety information to prevent occupational accidents and diseases, and the results were evaluated.

MATERIAL AND METHODS

In this study, a survey was applied to welding workers in a medium-sized organized industrial zone (Hitit University Ethics Committee, Date and Number: 28.06.2021/2021-73). This organized industrial zone is a mixed organized industrial zone. In this organized industrial zone, businesses such as machinery, agricultural equipment, food, plastic products, medical products, forest products, chemical industry, ceramics, marble, heat insulation, prefabricated building elements, casting, automotive sub-industry, textile, furniture and metal industry are producing. The survey applied consists of questions that evaluate the general demographic characteristics of the workers such as age, education, experience, work intensity, their background in the welding profession and their perspectives on occupational health and safety. The purpose of the survey is to determine the factors affecting occupational accidents and diseases in welded manufacturing and to minimize occupational accidents and diseases. Then, it was examined whether there was a relationship between the variables considered in the survey and occupational accidents and diseases.

RESULTS AND DISCUSSION

Some information about the welding workers to whom the survey study was applied is given in Table 3.1.

Table 3.1. Some information about the characteristics of welding workers [2]

Age	18-25	26-40	41-55	56-
Percentage (%)	22	40	28	10
Education	Primary school	Secondary school	High school	Vocational high school
Percentage (%)	12.5	32.5	27.5	27.5
Work experience	0-1	1-5	6-15	15-
Percentage (%)	10	42.50	30	17.50
Daily welding duration	1-2	3-4	5-6	7-8
Percentage (%)	10	40	42.5	7.5
Welding Method	Gas metal arc welding (MIG, MAG, TIG)	Covered Electrode	Oxy-Gas	
Percentage (%)	68	18	30	
Status of receiving occupational safety training	Yes	No		
Percentage (%)	88	12		
Risk assessment information	Yes	No	Partially	
Percentage (%)	25	15	60	
Use of personal protective equipment	Yes	No	Partially	
Percentage (%)	63	35	2	
Work accident situation	Yes	No		
Percentage (%)	48	52		
Number of work accidents	1-5	6-10	11-20	
Percentage (%)	74	21	5	
Occupational disease situation	Yes	No		
Percentage (%)	28	72		

The majority of the welding personnel participating in the survey are in the 26-40 age group. When the education levels of the participants are examined, it is seen that the rate of secondary school graduates is slightly higher than that of high school and vocational high school graduates. It has been determined that the rate of high school and vocational high school graduates is equal. Vocational high school graduates are mostly metal department graduates. As it is known, metal department students are given theoretical and practical training on welded manufacturing and occupational safety in their schools. It is seen that the majority of the participants have been working in welding for 1-5 years, and almost half of the employees have 6 years and more welding experience. A significant rate of 90% of the participants weld for more than 3 hours per day. The welding type most commonly performed by the participants in the survey is the gas metal arc welding method (MIG, MAG, TIG). Because gas metal welding is mostly used in the industry due to its advantageous features. The metal that is most commonly welded is steel materials. Because steel materials are the most preferred metal type in manufacturing due to their superior mechanical properties such as strength and shaping and their lower costs compared to other metals. A significant majority of the participants in the survey, 88%, have received training in the field of occupational health and safety in welding and welded manufacturing operations. This training was mostly received at the workplace and the vast majority of employees find this occupational safety training sufficient. Vocational high school graduates received this training at their schools. The rate of welding employees who have full knowledge of risk assessment, which forms the basis of occupational health and safety, is very low. Two-thirds of employees have partial

knowledge of risk assessment. It was determined that 53% of welding employees apply their occupational health and safety knowledge, while 45% apply it partially. The rate of use of personal protective equipment such as masks, helmets, gloves, and high-temperature-resistant work aprons is well below the required rate. Among the reasons for not using this equipment, the most frequently stated answer was "slowing down work". Approximately half of the welding workers who participated in the survey had at least one work accident, and these accidents were mostly non-injury or minor injury accidents that did not cause time off work. The hands, arms and eyes were the most damaged in these accidents. High-temperature metal spatter and welding rays spread around during welding are effective in these accidents. It is seen that approximately one-third of welding workers have an occupational disease. The most common occupational disease is musculoskeletal disorders. The reason for this is thought to be long working hours, non-ergonomic working positions and carrying heavy metallic materials by hand, as seen in the table.

Some demographic characteristics of welding employees and the relationship between occupational safety variables and occupational accident cases are given in Tables 3.2 and 3.3.

Table 3.2. Relationship between some demographic variables and occupational accidents [2]

		Has the participant had an occupational accident while welding?	
		Yes (%)	No(%)
Age range of the participant	18-25	33	67
	26-40	44	56
	41-55	45	55
	56-	100	00
Level education of participant	Primary school	40	60
	Secondary school	62	38
	High school	45	55
	Vocational high school	36	64
Welding experience of participant (years)	0-1	50	50
	1-5	41	59
	6-15	42	58
	Over 15	71	29
Daily welding duration of participant (hour)	1-2	75	25
	3-4	38	62
	5-6	53	47
	7-8	33	67
Vocational education status of participant	Yes	39	61
	No	78	22

Table 3.3. Relationship between some occupational safety variables and occupational accidents [2]

		Has the participant had an occupational accident while welding?	
		Yes (%)	No (%)
Participant's occupational health and safety training status on welded manufacturing	Yes	46	54
	No	60	40
According to the participant, are occupational safety trainings sufficient?	Yes	61	39
	No	00	100
	Partially	20	80
According to the participant, are occupational safety trainings necessary and important?	Yes	52	48
	No	50	50
	Partially	33	67
Does the participant apply occupational safety knowledge?	Yes	62	38
	No	100	00
	Partially	28	72
Does the participant use personal protective equipment?	Yes	37	63
	No	100	00
	Partially	67	33
According to the participant, is personal protective equipment alone sufficient to prevent work accidents and occupational diseases?	Sufficient	57	43
	Not sufficient	44	56
	Partially sufficient	47	53
Does the participant know risk assessment?	Yes	40	60
	No	50	50
	Partially	50	50

When we look at the relationship between the age of the participants and having an occupational accident, it is seen that there is a lower accident rate in the 18-25 age group compared to other age groups. The reason for this low occupational accident rate is thought to be that younger people apply the education they receive more meticulously, work more carefully, and employees aged 26 and over are more confident and pay less attention to occupational health and safety principles. When the relationship between the education level of welding workers and work accidents is examined, the lowest accident rate is seen in vocational high school graduates. Since a significant majority of vocational high school graduates are metal department graduates, they have received a lot of theoretical and practical training in this

department, welding manufacturing and occupational health and safety in welding manufacturing. The rate of occupational accidents in those with the most experience in welding work is higher than others. As in the age of the worker, it is seen that more experience also produces negative results due to overconfidence and disregard for work safety. A high rate of 78% of those who did not receive vocational training in welding had an occupational accident. There are various risks that cause occupational accidents in welding manufacturing works. Fire and explosions, electric shock, high temperature splashes burning the body, burrs in the eyes, welding rays damaging the eyes are some of these occupational accident risks. Therefore, it is not possible for people who do not receive vocational training in welding to fully know these risks and take the necessary precautions. In the study of Özalp and his colleagues on electrical hazards in welding works [11], it was emphasized that insufficient training and overconfidence of employees increase electrical accidents in welding works.

Occupational health and safety trainings related to welding works are also very important. Especially welding workers who do not receive vocational training should generally attend these trainings given at their workplaces. As mentioned above, vocational high school graduates receive this training at their schools. It is seen in Table 3.3 that the rate of occupational accidents in those who do not receive occupational safety training in welding works is higher. The rate of occupational accidents was higher in those who considered the occupational safety training they received sufficient. It is seen that welding workers who care about occupational safety very much and consider even the occupational safety training they receive insufficient do not have occupational accidents. The priority in occupational health and safety measures is collective protection methods and eliminating or reducing the risk at the source. In cases where the risk cannot be completely eliminated, personal protective equipment should be used. There is also personal protective equipment that should be used in welding works. As seen in Table 3.3, while the risk of occupational accidents is the lowest in those who use personal protective equipment, the rate of occupational accidents increases in those who use this equipment partially, and occupational accidents are inevitable in those who do not use it at all. Because some risks such as spatter and harmful rays in welding works cannot be prevented without this protective equipment.

A comparison of various variables and the occupational disease status of welding workers is given in Tables 3.4 and 3.5. When welding workers are examined in terms of occupational diseases, some findings in Tables 3.4 and 3.5 stand out. First of all, when the relationship between welder age and occupational diseases is examined, it is seen that the occupational disease rate is highest in workers over 56 years of age. Since occupational diseases occur due to the work carried out and repeated reasons at work, the duration of exposure to the risk of occupational disease increases as the welder's age increases. For example, the duration of exposure to mechanical effects, ergonomic difficulties, harmful welding rays such as visible, infrared, ultraviolet, and noise increases. Similarly, the occupational disease rate is highest in those with 15 and more years of work in the Table. In the study of Okumuş et al., it was stated that the age of the worker is one of the most important parameters in occupational diseases seen in shipyard welding workers [9]. Another striking finding in the tables is that the rate of occupational diseases is very low in those who receive occupational health and safety training in welded manufacturing. Similarly, it is seen that the rate of occupational diseases is lower in vocational high school graduates who receive this training. Those who do not receive this occupational health and safety training do not have knowledge about the risks that create many occupational diseases in welding works. For example, it is not known that noise above the specified limit will cause hearing loss in the coming years, and that welding rays can cause not only eye diseases but also many types of cancer. The increase in the number of welding hours per day also slightly increases the rate of occupational diseases since it increases the exposure time. Various musculoskeletal system occupational diseases such as back pain and herniated discs will occur as a result of long-term welded production, especially under unsuitable ergonomic conditions. Another striking point in Table 3.5 is that the rate of occupational diseases in welding workers who use personal protective equipment is much lower than in those who do not use this equipment. Masks and other work clothes used against welding rays, and earplugs used against noise, reduce the level of risks that cause many occupational diseases.

Table 3.4. Relationship between some demographic variables and occupational diseases [2]

		Has the participant suffered from any occupational disease due to welding work?	
		Yes (%)	No (%)
Age range of the participant	18-25	33	67
	26-40	13	87
	41-55	27	73
	56-	75	25
Level education of participant	Primary school	00	100
	Secondary school	46	54
	High school	30	70
	Vocational high school	18	82
Welding experience of participant (years)	0-1	25	75
	1-5	25	75
	6-15	8	92
	Over 15	71	29
Daily welding duration of participant (hour)	1-2	25	75
	3-4	27	73
	5-6	29	71
	7-8	33	67
Vocational education status of participant	Yes	27	73
	No	33	67

Table 3.5. Relationship between some work safety variables and occupational diseases [2]

		Has the participant suffered from any occupational disease due to welding work?	
		Yes (%)	No (%)
Participant's occupational health and safety training status on welded manufacturing	Yes	21	79
	No	80	20
According to the participant, are occupational safety trainings sufficient?	Yes	33	67
	No	50	50
	Partially	10	90
According to the participant, are occupational safety trainings necessary and important	Yes	29	71
	No	50	50
	Partially	22	78
Does the participant apply occupational safety knowledge?	Yes	30	70
	No	100	00
	Partially	22	78
Does the participant use personal protective equipment?	Yes	22	78
	No	100	00
	Partially	36	64
According to the participant, is personal protective equipment alone sufficient to prevent work accidents and occupational diseases?	Sufficient	29	71
	Not sufficient	40	60
	Partially sufficient	18	82
Does the participant know risk assessment?	Yes	11	89
	No	50	50
	Partially	29	71

CONCLUSIONS

In this study, occupational health and safety analysis was conducted in welded manufacturing works in a medium-sized mixed organized industrial zone and the general results and recommendations obtained are given below.

The rate of occupational accidents and diseases is lower in employees who have received vocational training and occupational safety training related to welding. Therefore, the state, employers and employees should give due importance to vocational training.

Approximately half of the welding workers do not apply the occupational safety training they receive or apply it partially. It is very important for occupational health and safety to create safety awareness and culture in employers and employees.
The full use of personal protective equipment by workers in welded manufacturing is not at the desired levels. Necessary training should be given and inspections should be carried out in this regard.

The most common occupational diseases among welding workers are determined to be herniated discs, hearing and eye disorders. To prevent this, working hours should be arranged appropriately and ergonomic improvements should be made. Personal protective equipment should be used to prevent hearing and eye disorders.

It is observed that the knowledge level of welding employees regarding risk assessment is quite low. Necessary training should be provided on this subject and the participation of employees in risk assessment activities should be ensured.

REFERENCES

1. Kaymaz Ö. Kaynak işlerinde iş kazası ve işe bağlı sağlık problemlerine neden olan faktörler ve KKD kullanımının bu faktörlere etkileri üzerine çevresel ve teknik araştırma, Çalışma ve Sosyal Güvenlik Bakanlığı İş Sağlığı ve Güvenliği Genel Müdürlüğü İş Sağlığı ve Güvenliği Uzmanlık Tezi. 2014.
2. Günaydın B. Orta ölçekli bir organize sanayi bölgesinin kaynaklı imalat işlerinde iş sağlığı ve güvenliği analizi. Yüksek Lisans Tezi. Hitit Üniversitesi Lisansüstü Eğitim Enstitüsü İş Sağlığı ve Güvenliği Anabilim Dalı. 2022.
3. Karadağ ÖK. Kaynak işlerinde iş sağlığı ve güvenliği, TTB Mesleki Sağlık ve Güvenlik Dergisi. 2001; 10: 27-32.
4. Akçakale N. Oksi gaz kaynağında iş sağlığı ve güvenliği, 2.International Symposium on Innovative Approaches in Scientific Studies, SETSCI Conference Indexing System. 2018; 3: 1434-1442.
5. Bozkurt Y, Keleş D. Ergitmeli kaynak yöntemlerinde açığa çıkan gaz ve dumanın çalışan sağlığına etkisi. Marmara Fen Bilimleri Dergisi. 2017; 4: 144-150.
6. Antonini JM, O'Callaghan JP, Miller DB. Development of an animal model to study the potential neurotoxic effects associated with welding fume inhalation. NeuroToxicology. 2006; 27: 745-751.
7. Turan A. Kaynak işlerinde iş güvenliği. Mühendis ve Makine. 2016; 57 (673): 24-28.
8. Yurtsever E, Özdemir G. Kaynak tekniği uygulamalarında iş güvenliği. Mühendis ve Makine. 2009; 50 (592): 2-9.
9. Okumus D, Fariya S, Tamer S, Günbeyaz SA, Yıldız G, Kurt RE, Barlas B. The impact of fatigue on shipyard welding workers' occupational health and safety and performance. Ocean Engineering. 2023; 285: 115296.
10. Sriram K, Lin GX, Jefferson AM, Stone S, Afshari A, Keane MJ, McKinney W, Jackson M, Chen BT, Berry DS, Cumpston A, Cumpston JL, Roberts JR, Frazer DG, Antonini JM. Modifying welding process parameters can reduce the neurotoxic potential of manganese-containing welding fume. Toxicology. 2015; 328:168-178.
11. Özalp Ö, Özay AD, Cömert MB, Çavdar PS, Çavdar U. Kaynak işlerinde elektrik tehlikelerinin iş sağlığı ve güvenliği açısından incelenmesi. Uluslararası Sağlık Bilimleri Kongresi, Bildiriler Kitabı. 2020; 229-233.
12. Teker T, Gençdoğan D. Türkiye'de kaynakçılık mesleğinde meydana gelen iş kazaları ve güvenlik önlemleri. Adıyaman Üniversitesi Mühendislik Bilimleri Dergisi. 2020; 12: 34-44.
13. Bayar U, Arabacı U. Kaynak çalışanlarının termal konfor düzeylerinin belirlenmesine yönelik bir inceleme. Mühendis ve Makine. 2023; 64 (713): 592-614.
14. Aydın F, Çidem Ç, Kahya E. Kabin üretimi yapan bir işletmenin kaynak atölyesinde iş sağlığı ve güvenliği risk değerlendirmesi. Ergonomi. 2018; 1 (3): 137-147.

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Observation of Appropriate Occupational Health and Safety Practices in an Underground Copper Mine

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Observation of Appropriate Occupational Health and Safety Practices in an Underground Copper Mine

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Abstract

In underground mining, occupational health and safety issues typically arise during the preparation and production processes, such as excavation, drilling and blasting, support construction, transportation, and ventilation. Miners may encounter these problems either continuously or periodically. This study is based on the observation of good practices, albeit rare, in underground mining operations in Turkey, rather than the absence of good examples in terms of mining technology and occupational health and safety. Therefore, there is a detailed examination of the precautions taken to mitigate significant health and safety issues that may arise from activities in an underground copper mine. In this way, by presenting how good practice activities are carried out in order of priority against the identified risks, it will contribute to reducing occupational accidents and occupational diseases in underground mining operations in Türkiye.

Keywords: Underground copper mining; ergonomic in mining; risk mitigation strategies; ventilation; drilling and blasting safety.

Introduction

Mining constitutes an important part of the industry and economy of all countries. Mining is considered one of the important economic sectors in most countries, as it provides the raw materials necessary for other sectors. Due to the sheer number of employees and the intensity of work, the mining sector is considered a risky sector worldwide, particularly in terms of occupational diseases and accidents. Additionally, the fact that mines encounter numerous uncontrollable parameters during operation has led the mining industry to become one of the most hazardous and challenging sectors. Therefore, the primary goal of many researchers' efforts is to identify and share different ways to reduce risks from these hazards (Hermanus, 2007; Radosavljević and Radosavljević, 2009; Bagherpour et al., 2017; Koçali, 2018; Yıldız, 2021; Esmailzadeh et al., 2022).

The mining sector contains many hazards such as fire, water flooding, inadequate ventilation, excessive noise, gas and dust explosions, and mine collapses. Therefore, at every stage of production, miners, equipment, and facilities can be exposed to all kinds of dangers. To prevent these dangers, necessary analyses must be conducted within the framework of the engineering discipline. If the mining operational period is long, appropriate planning and risk analysis should be carried out for that period (Önder et al., 2011; Karaahmetoğlu, 2019). Many studies have shown that even after miners leave the mine, they still develop occupational diseases due to the dust they encountered while working for years, or that existing occupational diseases gradually worsen.

Actions to be taken in underground mining activities must begin at the planning and project stage. Many factors, such as the characteristic structure of the valuable ore veins and surrounding rocks (gangue) within the mine, valuable mineral excavation, consumption of various materials (blasting, support, etc.), groundwater flow, and the gas component of the mine, are taken into consideration when planning the mine (Hermanus, 2007; Radosavljević and Radosavljević, 2009).

When planning production, the dimensions of the openings of the mine and supports are determined in the underground area where the ore is formed, and among the support types; it is decided whether the reinforcement will be wooden, steel, or concrete. The geological structure of the mine, the main rock, and the region where the ore is formed play decisive roles in selecting support types.

The most appropriate ventilation method should be determined by taking into account the conditions such as the gas characteristics present in the mine, the condition of fire-sensitive materials, the number of vehicles operating with diesel engines and the number of personnel involved, blasting practices required for mining production, dust formation, inadequate ventilation or short circuit situations, possible fires, etc. (Bagherpour et al., 2017; Karaahmetoğlu, 2019).

Additionally, the way to prevent an accident is to be informed about the near-miss incidents that could have started the accident. It provides us with opportunities to identify near-miss incidents and learn the precautions that need to be taken to prevent the accident from causing dire consequences and to eliminate its causes (Deniz and Yıldırım, 2024).

Ergonomics involves applying various techniques to create a human-machine-environment system that optimally balances workload and labor efficiency, protects employee health, and simultaneously increases productivity. The main goal of ergonomics is to improve the efficiency and safety of the human-machine interface (Deniz, 2011).

Figure 1. Non-ergonomic conditions of miners in underground mines

In most mines, work is often carried out without regard for human health and environmental impacts related to ergonomics, usually by individuals and organizations lacking

engineering training. In many sectors in Turkey, employees are encouraged to follow ergonomic principles. For example, numerous studies have addressed the ergonomics of seats for bank officers, bus or truck drivers. However, the fundamental practices of ergonomics are virtually absent in mining. Moreover, miners constantly face accidents and occupational diseases. Often, small-scale galleries (tunnels) are excavated underground to cut costs, forcing miners to walk and bend over while working. Additionally, in underground mines, miners are deprived of thermal comfort because they operate in extremely hot and humid environments when proper ventilation is not provided (Figure 1).

In Turkey, 700 people have lost their lives in the last 40 years due to firedamp or coal dust explosions. The mining disaster that occurred in the underground coal mine in Soma, Turkey, in 2014, which caused the deaths of 301 miners, is remembered as the deadliest mining disaster in the country's history.

When we look at the causes of deaths in mining accidents, we see that the lack of necessary precautions and, unfortunately, the "fatalistic" perspective of miners, especially public officials, are generally effective.

Although there are many underground mining operations in Turkey, the number of mining corporations with good mining practices is unfortunately very few.

Mining accidents and deaths will decrease if the number of businesses that implement good mining practices and attach importance to occupational health and safety increases in Turkey, as in developed countries around the world.

In this study, an underground copper mine site in Turkey, where good mining practices are implemented and necessary precautions are taken in terms of OHS, was examined, and it was aimed to contribute to the country's mining sector by presenting practices that will set an example, especially in terms of OHS.

Scope of the Study

The mine where the study took place is an underground copper mine located in the Mutki district of Bitlis province in Turkey, as shown in Figure 2.

Figure 2. General view of the construction site of the mining company

In the underground copper mine discussed in this study, there are 52 employees in total, including 1 business manager, 3 mining engineers, 1 Class B occupational safety specialist, 13 mine masters, 2 sergeants, 26 reserve personnel, 1 cook, 1 operator, 1 driver, 2 unskilled miners, and 1 sawmill operator.
In this study, one of the authors, who has been working at the mine site for two years as a Class B occupational safety specialist, observed the precautions taken against potential hazards and risks at the underground copper mine. Additionally, photographs were taken of procedures for implementing good OHS practices in the existing underground copper mine, one by one.

Appropriate OHS Practices in Current Underground Copper Mine

Ventilation is the most important elements in underground mining activities. The purpose of ventilation is to provide clean air to miners and to mining machinery using fuel-oil. Secondly, it involves removing toxic and suffocating gases from underground mines to prevent their accumulation and potential danger. Third, to prevent dust accumulation resulting from excavation and explosion in underground mines. Fourthly, the moisture created by the underground water and the heat generated as one goes deeper into the mine are removed from the mine by the ventilation.

Ventilation in underground mines occurs in two ways: natural and mechanical. Natural ventilation involves exchanging the air inside the mine with air from outside. In winter, warm air inside exits through the ventilation shaft on the upper floor, while fresh air enters via the ventilation gallery or shaft on the lower floor. This process is similar to how combustion gases in a stove are released through chimneys in homes. During summer, the airflow is reversed.

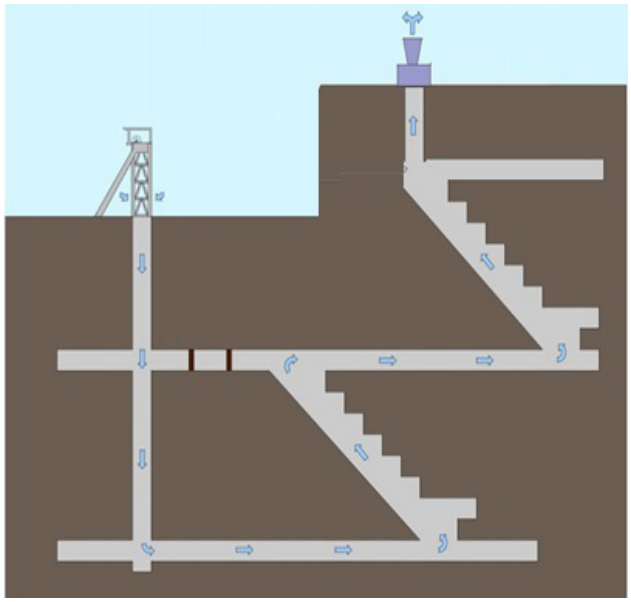

Figure 3. Combination of natural and mechanical ventilation

In mines where natural ventilation is inadequate, mechanical ventilation must be employed to ensure a proper working environment.

In Turkey, natural ventilation is generally preferred because of energy cost reasons. While natural ventilation may be sufficient in some new underground and small mines, it often isn't adequate. In old and large underground mines, natural ventilation is definitely not enough. As a result, many miners in Turkey lose their lives due to ventilation issues in underground mines. Therefore, a combination of natural and mechanical ventilation should be used (Figure 3).

At the existing underground copper mine, miners enter through the main entrance gallery shown in Figure 4 and extract ore, which is transported out via this entrance using wagons. A forced mechanical ventilation system has been installed at the gallery (tunnel) entrance, functioning also as a suction when needed. Additionally, a backup forced mechanical ventilation fan is available. However, it has been observed that the fan tubes are not fire-resistant.

Figure 4. Mine main entrance gallery and ventilation system

In the mine, miners use manual gas measurement devices for air and gases (Figure 5). These devices continuously monitor and record gas build-up in the mine. In a dangerous situation, the mine is abandoned according to legislation.

Figure 5. Manual air velocity measuring device [a] and gas measuring device [b]

In the existing underground copper mine, individual breathing masks (approximately 30 minutes) were also provided, as shown in Figure 6, so miners can breathe safely until they leave the mine due to hazardous gases or dust.

Figure 6. Individual breathing mask

The mining company keeps the rescue equipment shown in Figure 7 ready in case of a fire or collapse in the mine, in case the rescue team needs clean air. Additionally, a respiratory mask changing station has also been installed in case of an adverse situation that may occur underground, as shown in Figure 8.

Figure 7. The rescue equipment

Figure 8. Respiratory mask changing station

On the other hand, a shelter cabin was installed where miners could spend time until a rescue team arrived in the event of a collapse or fire. The interior of the shelter cabin is shown in Figure 9.

Underground mines are dark, making orientation difficult. Therefore, it is important to know whether a miner entering the mine has exited at the end of their shift.

Figure 9. The interior view of the shelter cabin

At the existing underground copper mine, mine safety warning signs are posted, and entrances are controlled. There is a miner's shift record book (Tike Lamp book in Figure 10a), and a Tike Board (Figure 10b) that everyone can see. In addition, each miner is given a tracking device and is systematically monitored with a computerized tracking program (Figure 11). In addition, underground location maps and direction signs showing where miners are underground and where they want to go are placed in various departments of the mine (Figure 12). In this way, if a problem occurs in the underground mine, the safety of the miners is increased as their location is known.

Figure 10. Miner's shift record book (Tike Lamp)[a], and a Tike Board [b]

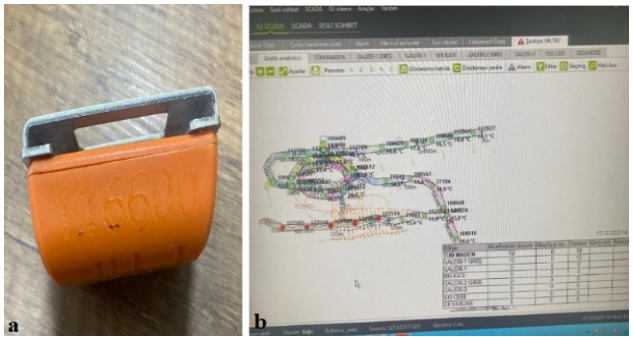

Figure 11. Miner's tracking device [a] and automatic miner tracking program [b]

Figure 12. Underground mine location map [a] and direction signs [b]

Additionally, because underground mines are dark, miners must use miners' lamps to see their surroundings (Figure 13). Unfortunately, these miners' lamps do not illuminate the entire underground area, only a small reflected surface. Due to insufficient lighting, especially for novice miners, it is often easy to get lost underground and difficult to find the mine's exit.

Figure 13. The dark working environment in underground mines

Lighting work has been carried out in the existing underground copper mine to enable miners to work more comfortably and find their way easily.

As seen in Figure 14, a green-red lifeline has been installed for exiting the mine, making it easier for miners to leave the

mine in case of an emergency. During danger, miners were equipped with green reflectors pointing towards the exit, while red reflectors warned of danger areas. Additionally, lighting systems were also installed, as shown in Figure 15, to help miners navigate underground.

Figure 14. Applications a lifeline using green reflection in the direction of exit from the mine [a] and red reflection in the danger zone [b]

Figure 15. Lighting systems of underground roads

Since 90% of the mines are made of rock, they can not be excavated by hand or machine. Therefore, to mine the mines, the mine rocks must be blasted with explosives. This process requires first drilling blast holes in the mine rocks in a specific order, into which the explosives will be placed, and then the holles are blasted (11, 12).

This hole drilling process has been done manually by miners for approximately 200 years (Figure 16). This process is both dangerous and tiring for the miners. Additionally, blasting underground with a magneto (blaster) often poses dangers and risks. If miners are inside the mine during underground blasting, flying rocks from the blasting can injure them. Moreover, miners may be affected by the dust and toxic gases released during the blasting, and they may also become trapped under rubble due to a collapse caused by the blasting.

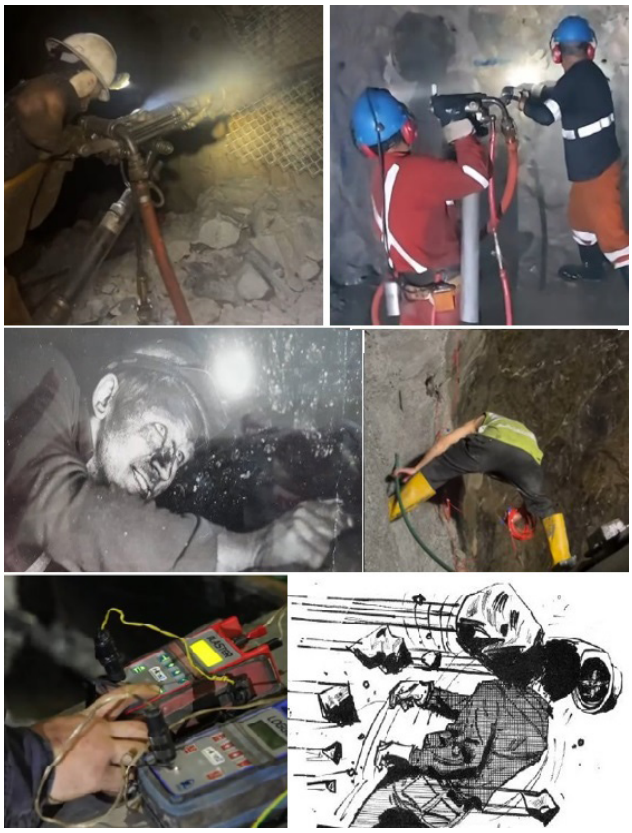

Figure 16. The process of miners manually opening blast holes, filling them with explosives and firing by blaster in underground mining

Before excavation in the existing underground copper mine, blasting holes are prepared on the excavation wall face where the mine is drilled with a drilling machine (Figure 17a). After the holes are drilled, the explosive materials combined with the explosive capsule are carefully placed by the blasting specialist with a blasting certificate (Figure 17b). Then, the electrical cable to which the capsule is attached is extended outside the mine and detonated safely when there is no miner in the underground mining (Figure 18).

Figure 17. The situation of the drilling machine for boring holes[a], and the explosive filling of the blasting holes to produce the mine [b]

Figure 18. Safe detonation of blasting holes from outside the mine by a blasting specialist

Miners should not work in areas where there is a danger of loose rock pieces falling from the ceiling due to gaps opened underground (Figure 19). The company carries out loading operations in such places using remote-controlled loaders. Thanks to the remote-controlled loader, injuries to miners due to some rock fragments that may hit their heads or any other part of their body are prevented. Figure 20 shows a remote-controlled loader used for underground loading.

Figure 19. Manual excavation and loading work of miners in underground mines

Figure 20. Remote-controlled underground loader

As excavations continue underground, groundwater flows into galleries and production areas through fractures and cracks. In order to prevent floods in the working environment and to remove water, water is collected in pools created within the mine and pumped out of the mine. Leaking groundwater is collected in pools created by taking advantage of the slope of the gallery roads to prevent the leaking groundwater from endangering the safety of both the miners and the various machines within the mine (13, 14).

On the other hand, pools can also be a source of danger, as miners can accidentally fall into the pool where water collects (Figure 21).

In the existing underground copper mine, to ensure the safety of the pools where underground water is collected, wire mesh guards were created, and warning signs were hung (Figure 22).

Figure 21. The difficult situation of a miner who fell into a pool of groundwater

Figure 22. The pool where underground water accumulates (a) is covered with a wire mesh to prevent any dangerous situation (b)

It is important to secure areas where mining has been done before and where mining has been abandoned. It is very important to carry out a controlled leave process in non-working areas, as both dangerous gas accumulation and oxygen deficiency will occur. Figure 23 shows a non-working area that has been completely closed with shotcrete and made airtight.

Figure 23. Closure of non-working areas

In case of any problems that may occur in underground mines, it is important to have an escape staircase that miners can use to climb up the ventilation shafts outside the main entrance gallery (Figure 24).

Figure 24. An irregular escape ladder created in an case of danger in an underground mine

Necessary precautions have been taken for emergency escape in the existing underground copper mine. Figure 25 shows the illuminated state of the escape staircase built in a ventilation shaft.

Figure 25. Ventilation and escape sahfts

Conclusion

Good ergonomic and OHS practices are widely adopted in all other sectors; however, although mining is considered the most dangerous sector in all countries, unfortunately, these good practices are rarely implemented.

In this study, some important observations on on-site mining activities and good practices, especially concerning OHS, in an underground copper mine operating in the Mutki district of Bitlis province were identified, and the findings were discussed.

Based on the investigations conducted at this underground copper mine, only 17 different cases of mining and OHS-compliant practices were identified. Other practices were not included in this study because they are also implemented in many underground mines.

As a result of on-site observations, it was determined that in order to raise awareness about occupational health and safety in the existing underground copper mine, training was given for 5-10 minutes every day, instead of 1 hour per week, before entering the mine. This situation reveals the importance of training on OHS, and we have confirmed that employees are conscious.

When managing noise and vibration, steps should be taken to reduce their impact. If ambient noise or vibration levels go beyond limits, workers should be encouraged to wear personal protective equipment. Additionally, miners should be supplied with suitable work shoes that have shock absorption features and elastic gloves.

In underground mining operations, necessary precautions should be taken to address the issues mentioned above,

and the benefits of preventing or mitigating these situations should be considered. In this context, awareness should be raised and monitoring activities should be conducted effectively.

One way to minimize accidents in mines is to reduce the human factor to a minimum level by replacing hazardous work done by human power with a mechanized production system.

Since mining activities are a very dangerous and risky business, good practices similar to this type of work should be examined, and it is very important to create a source of information that the sector can benefit from.

References

1. Hermanus, M.A. 2007. *Occupational health and safety in mining-status, new developments, and concerns*, Journal of South African Institute of Mining and Metallurgy, 107, 531-538.
2. Radosavljević, S., Radosavljević, M. 2009. *Risk assessment in mining industry: Apply management*, Serbian Journal of Management, 4(1), 91-104.
3. Bagherpour, R., Yarahmadi, R., Khademian, A., Almasi, S.N. 2017. *Safety survey of Iran's mines and comparison to some other countries*, International Journal of Injury Control and Safety Promotion, 24(1), 3-9.
4. Koçali, K. 2018. *Recommendations on nonconformities in coal mining in light of the* Şırnak *coal mine accident*, 21st International Coal Congress of Turkey "ICCT2018", 387-399, Zonguldak, Türkiye (in Turkish).
5. Yıldız, T. D. 2021. *Loss of profits occurring due to the halting of mining operations arising from occupational accidents or reasons related to legislation*, Gospodarka Surowcami Mineralnymi: Mineral Resources Management, 37(4), 153-176.
6. Esmailzadeh, A., Haghshenas, S.S., Mikaeil, R., Guido, G., Faradonbeh, R.S., Azghan, R.A., Jafourpour, A., Taghizadeh, S. 2022. *Risk assessment in quarries using Failure Modes and Effects Analysis Method (Case study: West-Azerbaijan Mines)*, Journal of Mining and Environment (JME), 13 (3), 715-725.
7. Önder, S., Suner, N., Önder, M. 2011. *Analysis of occupational accidents occurring in mining sector using risk assessment decision matrix*, 22nd International Mining Congress and Exhibition of Turkey (IMCET2011), 399-406, Ankara, Turkey (in Turkish).
8. Karaahmetoğlu, A. 2019. *Evaluation of Soma mines in terms of occupational health and safety in the context of Occupational Health and Safety Law No. 6331*, Journal of Social Policy Conferences, 76, 89-128 (in Turkish).
9. Deniz, V. Yıldırım, H. 2024. *An overview of the relationships between accidents and near-miss events*, Hitit Journal of Occupational Health & Safety, 1(2), 61-68.
10. Deniz, V. 2011. *Ergonomic application in quarries*, 6. National Quarry Symposium, 157-172, Sivas. (in Turkish).
11. Deniz, V., Deniz, O.T. 2017. *The environmental effects of the air shock generated by blasting*, Mugla Journal of Science and Technology, 3(2), 166-177.
12. Deniz, V., Deniz, O.T. 2018. *Environmental effect of delay time in open pit blasting*, Mugla Journal of Science and Technology, 4 (1), 5-10.
13. Alvarez, R., Ordóñez, A., Loredo, R.G.J. 2018. *An estimation of water resources in flooded, connected underground mines*, Engineering Geology, 232, 114-122.
14. Chi, M., Zhang, D., Fan, G., Zhang, W., Liu, H. 2019. *Prediction of water resource carrying capacity by the Analytic Hierarchy Process Fuzzy Discrimination Method in a mining area*, Ecological Indicators, 96(1), 647-655.

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Occupational Health and Safety in Archaeological Fieldworks

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Occupational Health and Safety in Archaeological Fieldworks

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Abstract

Safety risks encountered during archaeological excavations vary depending on the historical period under study and the working methods applied. In restoration works, the use of heavy machinery creates excavation environments that may result in fatal accidents. In Anatolia, particularly in mound (höyük) excavations, the most critical safety issue arises from the excavation profiles. When profiles exceed one meter in height—often to emphasize the grandeur and magnificence of a mound—each profile carries potentially lethal risks. Therefore, high profiles must be adequately reinforced. In Turkey, the collapse of excavation profiles and the subsequent entrapment of workers beneath them constitutes a frequently observed hazard in mound excavations. This study adopts a qualitative research approach in order to identify occupational health and safety risks associated with archaeological excavations. The methodology incorporates a review of the literature, field observations, and the development of recommendations. The study aims to highlight the preventive measures required in contemporary excavation practices by examining perspectives on occupational health and safety within archaeological contexts. The research further investigates the occupational health and safety challenges that arise from severe injuries and even fatal accidents occurring during excavations. Consideration has been given to site conditions, risk factors, risk assessment processes, and the interrelation with occupational health and safety. Within this framework, the study presents both precautionary measures and a set of practical recommendations.

Keywords: Archaeological Excavation, Personal Protective Equipment, Occupational Safety in Archaeology, Ergonomics, Risk Factors in Excavations.

INTRODUCTION

Archaeological Field Studies

Archaeological fieldwork involves excavations carried out by archaeologists to uncover structures, documents, and other remains that have been buried under soil or water for centuries, often covered by the remnants of other cultures. Through these excavations, data are obtained about the civilizations that once lived in the region, such as their cultural practices, the materials they used, the characteristics of their architectural structures, dietary habits, and ways of life, and transferred to future generations. Archaeological excavations yield artifacts such as handmade objects, household items, hunting tools, weapons, and works of art. Grain or pollen remains recovered from archaeological contexts provide information about geography and vegetation. Human skeletons unearthed during excavations reveal individual characteristics as well as the lifestyle, socio-economic and socio-cultural structures, morphological features, and health conditions of the societies they belonged to, along with their similarities and differences compared to other communities.

Archaeologists conduct significant work not only in academic settings but also in laboratories and the field. Archaeological work requires strenuous activities such as field surveys, walking long distances, climbing steep slopes, and exposure to sun, wind, and rain. The occupational hazards faced by archaeologists are generally categorized as physical, biological, and environmental risks [1]. Physical hazards primarily involve adverse factors in the physical environment that may cause harm either through direct contact or indirectly. For an archaeologist, radiation, heat, and noise are among the physical hazards. Biological hazards include bacteria, viruses, insects, plants, and animals, all of which may cause a range of health problems from allergic reactions to infections. If appropriate precautions are not taken, archaeologists may become infected through contact with bacteria that can survive for extended periods. Chemical hazards arise mainly from exposure to various substances used while examining and preserving artifacts. These chemicals can lead to acute or long-term health issues. Working long hours in extreme heat or cold in open terrain also presents the potential risk of archaeologists developing hyperthermia or hypothermia [2]. In addition to excavation activities, restoration projects involving archaeological artifacts include multiple disciplines and therefore contain unique hazards and risks. The form and severity of these risks may vary in restoration practices, and a wide range of factors contribute to the likelihood of both occupational accidents and occupational diseases. In restoration works, if there is any damage to the structure or artifact, the cause is first identified, and then the appropriate method of intervention is determined [3].

Archaeology is a physically and mentally demanding profession, and archaeologists often have to work under unsafe conditions in challenging climatic and geographical environments. In our study, we emphasize these difficult conditions and propose safety measures aimed at reducing the potential dangers. By adhering to safety protocols, excavation teams can significantly reduce the number of workplace accidents. A safe working environment must be established for archaeologists, and strict compliance with safety and precautionary measures must be ensured.

Making occupational accidents experienced by archaeologists in excavation areas more visible and better known is only possible through increased research in this field. It is essential to identify the working conditions, deficiencies, and inadequacies at excavation sites. Evaluating the current situation and initiating work based on identified needs is also a matter of importance.

Archaeology is a profession with exciting goals and objectives, but it is not without risks [4]. The health and safety conditions at archaeological sites are often unpredictable at first glance. Excavation sites may be located far from residential areas and may contain deep trenches, caves, or underground tunnels. Archaeologists working in enclosed spaces may be at risk due to dangerously low oxygen levels, high concentrations of carbon monoxide, or exposure to other hazardous substances. Excavation team members on site may also

face biological hazards such as insects, snakes, plants, and soil- or waterborne organisms. Any archaeological site can be compared to a construction site, and the rules that apply to construction areas should also be enforced at excavation areas.

Attention must be paid to moving machinery, unstable ladders, hazardous wheelbarrows, and electrical cables. Work should be planned with awareness of potential collision and fall hazards. Areas that may endanger workers, such as pits or trenches, must be isolated.

Archaeological excavations are carried out by a team consisting of scientists, students, and workers, each of whom undertakes a variety of tasks. The identification of the excavation site is conducted with the help of historical documents, maps, and satellite imagery. Once the area has been identified, both surface and subsurface surveys are performed. Following these surveys, the excavation is planned, a temporary settlement area is established, and the excavation process begins. The findings are identified, classified, recorded, and examined by relevant specialists. After the analyses conducted by archaeologists, epigraphers, topography experts, biologists, architects, restoration specialists, and professionals from various other disciplines, the results are interpreted.

In Türkiye, excavation and survey activities include underwater research, salvage excavations in public investment areas, underwater excavations, surface surveys conducted by foreign scientific teams, and excavations carried out by museum directorates.

Risk Factors in Excavations

In archaeological fieldwork, various visible and invisible factors threaten the health of personnel involved. Because the adverse effects caused by these factors are often not taken seriously, many hazards cannot be identified before they arise. Risk sources that may endanger health and safety must be identified, and it should be determined who may be harmed and in what way. Furthermore, appropriate health and safety measures should be taken based on the results of risk analyses.

Among the physical risk factors are the use of heavy equipment, electrical tools, and working under challenging weather conditions. Heavy machinery used to facilitate deep excavations and remove soil from the site can cause serious injuries or fatalities. When soil is being lifted or loaded using machinery, no personnel should be allowed to work underneath or in front of the equipment. The primary risks associated with the use of electrical hand tools are abrasions and lacerations. Regular maintenance and inspection of these tools are mandatory, and they must only be operated by trained individuals.

Physical environmental factors at the worksite include temperature, humidity, air velocity, thermal comfort conditions, lighting, noise, vibration, and radiation. Thermal comfort refers to the ability of workers to perform their tasks comfortably with minimal adverse effects from environmental or job-related conditions. Noise and vibration are among the factors that affect workers and must be taken into account in occupational hygiene practices. Measures must be implemented at the source, in the environment, and at the individual level by regulatory limit values [5].

Chemical Risk Factors

Chemical hazards are defined as factors that can contaminate any type of material present in the working environment, such as food, air, equipment, tools, and the external parts of the human body that come into contact with the surrounding environment and that alter, to a lesser or greater extent, the chemical composition of the environment. Chemical substances are classified into three primary states: solid, liquid, and gas. In addition to these physical states, chemicals are also described based on the types of hazards they pose, including toxic, allergenic, mutagenic, teratogenic, immunotoxic, asphyxiant, carcinogenic, flammable, oxidizing, and explosive properties [6].

Acids and chemicals used by laboratory personnel for the preservation, restoration, or identification of archaeological materials can pose significant risks when improperly handled or stored. Additionally, mold outbreaks in laboratories or on archaeological artifacts may cause respiratory symptoms, skin and eye irritation, and, in rare cases, infections. In such instances, if a toxic mold species is identified, a particulate-filter respirator should be used instead of a standard dust mask. Disposable plastic gloves, single-use coveralls, or lab coats should be worn, and any non-disposable equipment must be disinfected regularly.

The chemicals used during restoration work on architectural artifacts also present serious hazards. For example, during the removal of oil-based paint from wooden architectural structures, exposure to dust, skin contact with paint strippers, or inhalation of chemicals released from heat guns can occur. Moreover, chemical exposure is most prevalent during cleaning processes. Harmful vapors may be released when applying absorbent gels, epoxies used in stone restoration, and organic solvents. Due to the significant risks posed by these substances, the chemicals used in all such processes must be carefully reviewed, and a comprehensive risk assessment should be conducted to inform and protect the personnel involved [3].

During excavation activities, fires may result from physical factors such as electrical hazards or hot work, especially when working on wooden structures or in the presence of chemical substances. If archaeological work must be conducted in areas containing flammable materials, even a spark from a flashlight can cause ignition. Smoking in the field constitutes a significant risk factor and must be strictly prohibited [3].

Biological Risk Factors

Biological hazards refer to microorganisms, cell cultures, and human parasites that may cause infections, allergic reactions, or poisoning. Such hazards are commonly present in health-related sectors, slaughterhouses, livestock farms, veterinary practices, butcheries, agricultural settings, wastewater treatment facilities, and elderly or childcare institutions.

The most frequently encountered diseases resulting from biological agents include hepatitis, salmonellosis, anthrax, brucellosis, polio, diphtheria, tuberculosis, Legionnaires' disease, influenza, and meningitis [7].

In archaeological excavations, biological risks may arise from animal feces, organic materials, and microorganisms embedded in artifacts. Insects and rodents are also considered biological risk factors, and archaeologists must be adequately informed about these hazards. One of the most common threats archaeologists face in the field is toxic plants. Contact with the leaves and vines of these plants or the disturbance of their roots during excavation may cause itching, blistering, and widespread skin rashes at any time of the year. To mitigate such risks, toxic plants should be removed whenever possible, and protective clothing such as gloves should be worn. In addition, protective creams, soap, and water for washing exposed areas, first-aid medications, and plant identification training should be provided [8].

Tetanus is one of the most critical risks in archaeology. Even contact with soil may lead to tetanus if precautions are not taken. Common minor injuries in excavation sites—such as small cuts or puncture wounds from thorns—significantly increase the risk of this potentially fatal disease. Therefore, everyone involved in archaeological fieldwork must be vaccinated against tetanus.

Although viruses transmitted by ticks are rarely fatal, they can cause partial paralysis in joints, nerves, or the heart [9]. Individuals conducting archaeological research, who often spend extended periods outdoors in areas with tall grass or dense vegetation, are especially vulnerable to such exposure. Field teams should wear long-sleeved clothing and tuck their pant legs into their socks. Light-colored clothing makes it easier to detect ticks. Workers should be advised to thoroughly check their entire bodies after working in such environments. In archaeological sites, additional risks may include infected blisters, cuts, abrasions, bone fractures, allergic reactions, and dehydration. Field crews must be equipped with all necessary supplies to respond to these conditions effectively.

Ergonomic Risk Factors

The primary principle of ergonomics is to adapt the workplace and the nature of the work to suit the workers. Ensuring ergonomic conditions in work environments enhances productivity and employee satisfaction, while significantly reducing the likelihood of occupational diseases caused by physical and psychological factors [10].

In archaeological fieldwork, various musculoskeletal disorders are likely to occur due to the nature of the tasks performed. These include lower back and upper back pain, neck pain, cervical disc herniation, lumbar disc herniation, carpal tunnel syndrome, tension neck syndrome, thoracic outlet syndrome, and epicondylitis.

Figure 1. Archaeologist working in an ergonomic risk environment

Prolonged excavation work can lead to a decline in workers' quality of life and a decrease in job performance. Repetitive, unnecessary movements, excessive physical exertion, and incorrect postures during tasks are among the leading causes of such disorders. To protect workers from these health issues, ergonomic improvements and workplace adjustments should be implemented.

For example, a worker who must stand for extended periods or remain in a fixed position may experience fatigue, which can result in reduced concentration. As a consequence, the worker may rush to complete a task, increasing the risk of a workplace accident [11].

Ergonomic risk factors are categorized as prolonged working hours, intense concentration, repetitive movements, twisting, pulling, reaching, heavy lifting, and improper working postures [12].

Risk Assessment and Management

Risks in excavation work are constantly variable; therefore, it is essential to assess and identify them continuously. Each excavation site presents its own set of challenges, and these challenges require individual solutions. Consequently, there is no single definitive approach to occupational health and safety—multiple solutions may exist for a given problem [13]. Archaeological fieldwork exposes archaeologists to numerous hazards. Since archaeological projects are often short-term and scientifically focused, these risks are frequently underestimated. The lack of Turkish-language resources on occupational health and safety in archaeological contexts further suggests that these risks are often overlooked. Occupational safety risks in archaeological sites include: extreme weather conditions, the local habitat, artifact cleaning and restoration, excavation tools, insufficient personal protective equipment (PPE), handling of skeletal remains, lifting and transporting architectural blocks, unstable ground conditions, inadequacies in excavation house infrastructure, hygiene in shared areas, dust exposure, and use of chemicals during the treatment of metallic residues undergoing chemical changes.

In cases where archaeological work must be conducted in areas containing flammable materials, even a spark from a flashlight can cause ignition. Smoking in the field is also a significant risk factor and must be strictly prohibited [3]. Common workplace accidents on archaeological sites include limb entrapment or crushing by machinery, impact or falling materials, trench collapses, electric shock, and accidents involving explosive materials.

Archaeologists are professionals who frequently keep detailed records. This habit of documentation can also serve occupational health and safety purposes. For example, if all incidents, including minor injuries like thorn pricks, are recorded throughout an excavation season, valuable data can be collected for understanding site-specific risks. If these records are regularly reported, more effective preventive measures can be implemented.

Funding for essential site conditions, including shelter, nutrition, hygiene, medical services, occupational safety, and social adaptation, should be covered by the excavation budget provided by the Ministry. The presence of a certified safety specialist, availability of protective equipment, proper ventilation and temperature control in laboratories, safe handling of chemicals, comfortable working conditions, long working hours, stress, and other risk factors all require special attention.

Risk assessments should be conducted with the participation of all team members and should consider the specific conditions of each work unit. Collaborative evaluation and analysis reports based on shared perspectives can help generate effective risk management strategies. Risks within excavation houses should be assessed from the standpoint of personnel working in different roles. Since fire hazards are among the most common in excavation houses, fire extinguishers must be readily available, and all personnel must be trained in their use. Additionally, a comprehensive inventory of chemical substances should be maintained, along with written emergency procedures. Chemicals must never be stored in unlabelled containers.

In Türkiye, one of the ongoing challenges in archaeological fieldwork is the inadequacy of comfortable and safe working conditions. Archaeologists often lack easy access to excavation materials and sufficient equipment for accident prevention. Due to limited excavation budgets, many sites do not have dedicated occupational safety specialists, nor is safety training provided to archaeologists. As a result, proper precautions against potential accidents are not taken, and workplace accidents are often not reported. In many excavation sites, even designated smoking areas are unavailable.

The aim of this study is to determine the main risk factors encountered in archaeological excavation sites, to examine the consequences of these risks in terms of occupational health and safety, and to reveal the precautions that need to be taken. In addition, by developing suggestions for field applications, it is aimed to contribute to the creation of a safer working environment for researchers and workers working in excavations.

Materials and Methods

A qualitative research design was adopted to identify occupational health and safety (OHS) issues encountered in archaeological excavation sites and to propose potential solutions. The methodological framework included a comprehensive literature review, field observations, risk assessment, and the development of recommendations. Scholarly publications and legal regulations addressing OHS in archaeological excavations, both in Türkiye and internationally, were systematically examined. Specifically, Türkiye's Occupational Health and Safety Law No. 6331, the relevant directives issued by the Ministry of Culture and Tourism, as well as standards established by the International Labour Organization (ILO) and the Occupational Safety and Health Administration (OSHA) were analyzed.

Direct observation techniques were applied in mound (höyük) excavations and restoration projects undertaken in Anatolia. The study assessed the physical conditions of excavation sites, the excavation methods employed, the use of heavy machinery, the height of excavation profiles, and the adequacy of implemented safety measures. Special attention was devoted to the risks associated with the collapse of high profiles and to hazards stemming from the operation of heavy machinery.

The hazards identified in excavation sites were analyzed using the risk matrix method, taking into account both probability and severity levels. Based on this assessment, risks were categorized as low, medium, or high. Among the high-priority risk factors, profile collapse, contact with heavy machinery, and insufficient use of protective equipment were found to be the most critical.

Findings from the literature review, field observations, interviews, and risk assessments were synthesized to propose practical and sustainable occupational health and safety (OHS) measures applicable to archaeological excavations. These recommendations were presented in comparison with national and international standards.

Literature Review

Archaeology is the scientific discipline that endeavors to reconstruct past cultures and civilizations by studying their remnants. Since most of these remains are buried underground, excavation is necessary to uncover them. Excavation techniques are an indispensable component of archaeology and play a crucial role in fieldwork. Accordingly, while it is possible to define archaeology as the science of excavation, it also seeks to reconstruct non-living cultures by collecting data from identified cultural assets and written documents [14]. Archaeological excavation sites, by their nature, are work environments that carry the risk of archaeological accidents and injuries. During excavation work, archaeologists are exposed to significant health risks such as infectious diseases, radioactive and chemical substances, volatile and toxic gases, and insect or bug bites. Potentially hazardous chemicals are far more common than generally assumed. These chemicals can enter the body via inhalation

while conducting surveys, digging trenches, or cataloging uncovered artifacts. Therefore, it is critically important to understand which substances one may be exposed to, their toxicity, and the levels of exposure [15].

Chronic illnesses and pre-existing medical conditions also shape the daily lives of many archaeologists, both in the field and outside it. Such conditions may go unnoticed by project directors and team members, as they are often considered ordinary or overlooked until a serious complication arises. As a result, they are frequently neglected in safety planning, which tends to focus primarily on emergency situations. Archaeological fieldwork may introduce new stressors that exacerbate chronic conditions or pre-existing illnesses, potentially leading to life-threatening situations if not managed properly [16].

In a study addressing health and safety concerns during excavations, hazards such as collapses, falls, and entrapment were analyzed. Strategies for accident prevention—including safety training, the use of appropriate equipment, and engineering controls—were discussed. The study also outlined specific measures to mitigate risks and address safety concerns associated with excavation activities [17].

Occupational health and safety (OHS) in archaeological fieldwork is evaluated within the framework of Türkiye's general workplace safety legislation. However, no regulation specifically dedicated to this field currently exists.

- The Occupational Health and Safety Law No. 6331 applies to all workplaces but does not provide special provisions tailored to archaeological excavations.
- Excavation and research directives issued by the Ministry of Culture and Tourism primarily address scientific procedures and refer to OHS measures only in general terms.
- Regulations of the Ministry of Labour and Social Security establish detailed rules for construction and construction-site activities, yet they do not set direct standards for archaeological excavations.
- The International Labour Organization (ILO) has developed general standards for worker health and safety in fieldwork.
- In the United States, the Occupational Safety and Health Administration (OSHA) provides comprehensive guidelines for excavation and laboratory safety.
- The European Union's Occupational Health and Safety Directives define protective measures covering open-air worksites and excavation areas.

When comparing practices in Türkiye with international examples, the absence of a specific OHS regulation for archaeological excavations emerges as a significant shortcoming. Considering that excavation sites share similar risks with construction sites, it is recommended that a national "Occupational Health and Safety Regulation for Archaeological Works" be established, and that the presence of specialized safety professionals at excavation sites be made mandatory.

Risk Categorization

In archaeological fieldwork, it is necessary not only to identify risks but also to classify them according to their probability and severity. This classification requires continuous monitoring of risks in both field and laboratory settings. Preventive measures must be mandatory in cases of high-risk situations. For medium-risk situations, emphasis should be placed on training, supervision, and the use of personal protective equipment (PPE).

Table 1. Risk Levels in Archaeological Fieldwork

Risk Factor	Probability	Severity	Risk Level	Recommended Measures
Section Collapse	Moderate	Fatal	High	Section bracing, safety barriers, site manager supervision
Chemical exposure (restoration)	High	Moderate	Moderate-High	Masks, ventilation, proper storage, training
Ticks and biological agents	Moderate	Severe	Moderate-High	Vaccination, protective clothing, regular checkups, training
Sunstroke and dehydration	High	Moderate	High	Water supply, breaks, shade, sunscreen
Heavy lifting / ergonomic risks	High	Moderate	Moderate	Ergonomic training, lifting equipment, job rotation
Power tool accidents	Moderate	Severe	Moderate-High	Periodic maintenance, use of qualified personnel
Fire (chemical/ electrical)	Low	Fatal	Moderate	Fire extinguishers, smoking ban, emergency plan

Personal Protective Equipment

Personal protective equipment (PPE) refers to wearable or attachable items designed to protect workers from potential occupational hazards [18]. These materials are mandatory in order to prevent workplace accidents or the development of occupational diseases. Head protection includes protective helmets commonly used in mining, construction sites, and various industrial areas, as well as caps, hairnets, and protective hoods used to protect the scalp. Hearing protection comprises earplugs, earmuffs, and hearing protection devices equipped with internal communication systems [19].

Safety glasses, diving-style goggles, X-ray glasses, laser protection glasses, ultraviolet goggles, and face shields provide eye and face protection. Respiratory protection includes masks with gas, dust, or radioactive particle filters, air-supplied respirators, and respirators equipped with attachable welding visors.

Hand and arm protection involves specialized protective gloves such as those designed for protection from machines, chemicals, electricity, and heat, as well as finger guards, arm sleeves, wrist guards for heavy-duty work, fingerless gloves, and other protective glove types. For foot and leg protection, long boots, safety boots and shoes, heat-resistant footwear, and gaiters are used [20]. Additionally, while working in the

field, protective creams and ointments should be applied to prevent insect bites and sunburns. To avoid bites or stings from insects and other animals, long-sleeved shirts and long pants should be worn, and basic first aid training should be provided. To prevent sunstroke and dehydration during excavations, workers should drink plenty of water, take regular breaks in shaded areas, and always apply sunscreen.

Archaeological Fieldwork Equipment

As archaeology involves the study of all types of material remains related to social life, excavation tools must be employed using various techniques that avoid causing any damage to the artifacts [21]. Standard field equipment used during these operations includes: trowels, brushes, brooms, hoes, shovels, dental tools, measuring tapes, surveying and drawing instruments, machinery and mechanical tools, recording devices, chemical substances, and artifact bags.

Figure 2. Archaeological Excavation Equipment

Excavation teams should be informed about the mandatory use of personal protective equipment (PPE) to prevent occupational accidents and work-related illnesses. PPE is material specifically designed for various protective purposes and adapted to the work environment to safeguard workers against health and safety risks. Essential PPE for archaeologists includes heat-resistant clothing, gloves, safety goggles, helmets, and fall-arrest harnesses, among others [1].

Different equipment is used depending on the specific risks encountered during archaeological work, with helmets being the most commonly recognized. Helmets can often cause discomfort and are especially challenging to wear during the summer months. Protective eyewear, gloves, knee, and elbow pads are critically important on excavation sites. It is common for soil or stone particles to strike the eyes of archaeologists and laborers. Additionally, wind may blow dust and dirt into their eyes. Therefore, appropriate transparent or tinted protective goggles must always be worn during excavation activities. Unless the archaeological site's structure requires barefoot work, such as mosaic floors, safety boots must be worn at all times. Using such boots significantly reduces foot injuries. As with any work environment, one of the most important safety measures in archaeological fieldwork is to keep a first aid kit readily available. Ideally, several team members, or even the entire team, should be trained in first aid to mitigate the severity of any potential accidents [13].

Emergency Procedures and Information

Effective emergency notification and warning are vital for ensuring worker safety. It is essential to establish a robust emergency communication and alert system. Clear procedures must be in place instructing employees on how and where to report emergencies, and training should be provided to familiarize staff with these protocols.

An emergency plan should be developed to identify hazards and assign responsibilities. Alert systems, including alarms, visual and auditory warnings, and even mobile notifications, must be employed to inform all personnel. These systems should be designed so that everyone can hear or see the alerts, and backup power sources should be available to prevent system failures. Audible alerts should be distinct and attention-grabbing.

Designated assembly points and evacuation routes within the excavation site must be communicated to the team. Written instructions outlining the steps and procedures for each type of emergency should be prepared and distributed to all workers to ensure a clear understanding of emergency protocols. Communication tools to be used during emergencies must be identified, and a communication chain established. Contact information and procedures for external emergency services such as fire departments, ambulances, and police should be documented.

Before the commencement of excavation activities, alarm systems and other warning devices must be regularly inspected and maintained. Emergency plans and contact information should be reviewed and updated routinely to ensure ongoing readiness.

Case Studies in Archaeological Field Studies

The lack of proper occupational health and safety practices in archaeological excavation sites has led to several unfortunate incidents. In 2012, American archaeologist Chad DiGregorio passed away during a surface survey conducted in Manisa, Türkiye. Similarly, in February 2014, German archaeologist Prof. Dr. Lothar Herling died while conducting archaeological research in the Turkish Republic of Northern Cyprus (TRNC). Herling reportedly slipped in the excavation area, fell from a height of one meter, hit his head, and succumbed to the injury [22, 23].

In 2022, 52-year-old archaeologist Murat Kurt traveled from Istanbul to Erzurum for excavation work. While conducting archaeological research in Akşar village, Şenkaya district, he noticed a tick had attached to his body. After removing it himself, he continued working in the field. However, he later felt unwell and was taken to Oltu State Hospital. Despite receiving intensive care, Murat Kurt tragically passed away [24].

Building relationships with residents in excavation areas can also be challenging for archaeologists. Unfortunately, tensions between archaeologists and people living near excavation sites can escalate and, in some tragic cases, end in violence. In 2019, during excavations at the ancient city of Olympos in Antalya, 32-year-old archaeologist Sinan Sertel, a Ph.D. candidate and deputy excavation director, was fatally stabbed in the chest during a dispute allegedly sparked by claims of tree cutting in the excavation zone. He died en route to the hospital, despite medical intervention [25].

CONCLUSION

The fieldwork aspect of archaeology, in particular, is physically demanding. Improving physical conditions can significantly aid the execution of the work. However, everyone heading to the field or the laboratory must be aware of the various potential health issues and be prepared to deal with them. Health problems are not limited to accidents and insect bites; there are also general health issues that may arise.

Before starting archaeological excavations, occupational safety analysis, risk assessment, determination of precautions, and preparation of the necessary documents are highly important. To prevent potentially fatal accidents, a specific occupational health and safety regulation tailored to archaeological fieldwork should be prepared. Archaeologists should be granted the right to work as experts in occupational health and safety, and it should be mandatory to have such experts present at excavation sites.

Each excavation site should maintain appropriate health and safety records, including accidents, injuries, and illnesses. These incidents must be documented with reports that include findings and results. Archaeological fieldwork often involves excavation activities similar to those in the construction sector.

A significant hazard of working in confined or enclosed spaces is the lack of oxygen. In excavations near landfills or swamps, processes like bacterial fermentation may displace oxygen. Rust formation can also reduce oxygen to unhealthy levels. Accumulation of methane gas may lead to explosions, especially in areas where organic matter is decomposing.

Archaeologists may be exposed to rodents and the viruses carried by their droppings. The best protection is for field personnel to conduct a thorough assessment of the area and remain cautious. Gloves should always be worn, surfaces should be cleaned with disinfectants, and the area should be kept damp to minimize airborne dust. When cleaning or transporting materials, masks with filters should be used to protect the respiratory system [26].

Each excavation site must create its risk assessment form. These forms should be completed by archaeologists working both in the field and in the laboratory, as well as the entire excavation team. Risk assessments help identify hazards related to the work. After these assessments, existing precautions and their effectiveness should be reviewed, and work-related accidents should be carefully examined. For risk assessment, first, a hazard must be identified and, if possible, eliminated. The individuals who might be affected by the hazard should be determined.

According to the research report titled “Occupational Health and Safety in Türkiye with Statistics,” published by the Occupational Health and Safety Directorate General of the Ministry of Family, Labour and Social Services of the Republic of Türkiye in 2020, no specific records were kept regarding archaeologists and other occupational groups working in excavation areas. Both archaeologists and anthropologists, as well as other excavation team members, are at risk, and the issues they face are unknown.

Archaeologists must receive basic first aid training. Before starting fieldwork, work areas should be inspected to identify any potential hazards. Identified risks should be addressed appropriately, and the entire team working in the field must be informed about potential dangers. Individuals with special health conditions, such as allergies, should be identified before excavation work begins, and an emergency response team should be formed. In cases where research must be conducted in remote areas, a communication system must be established. Every excavation site and excavation house should have a sufficient first aid kit. The excavation team should have the phone numbers of the nearest rescue team and hospital.

In archaeological excavations and all fieldwork involving archaeologists and anthropologists, an occupational health and safety expert must be present. This expert should be responsible for implementing precautions and conducting inspections. Considering the various risk factors and outcomes faced by excavation teams, the seriousness of the work becomes evident. Negligence can lead to loss of life among workers. This possibility alone highlights the sensitivity of the issue. With contributions and recommendations from the Ministry of Labour and Social Security and the Directorate General of Occupational Health and Safety, a regulation specific to excavation workers should be prepared, and a monitoring mechanism should be established.
Archaeologists should receive basic training in first aid. Before commencing fieldwork, excavation sites must be inspected to identify any potential hazards. Identified risks should be properly addressed, and all team members working on site must be informed about possible dangers. Individuals with specific health conditions, such as allergies, should be identified prior to the commencement of excavations, and an emergency response team should be established. In cases where research must be conducted in remote areas, a reliable communication system must be set up. Adequate first aid kits should be available both at excavation sites and in excavation houses. All excavation team members should have access to the contact information of the nearest emergency rescue units and hospitals.

In archaeological excavations, archaeologists and anthropologists must be supported by an occupational health and safety (OHS) specialist as part of the excavation team. This specialist should be responsible for both implementing and monitoring safety measures. Considering the various risk factors and their possible consequences, the seriousness

of the issue becomes clear. Negligence may even result in loss of life, which alone highlights the sensitivity of the matter. With the contributions and recommendations of the Ministry of Labour and Social Security, Directorate General of Occupational Health and Safety, specific regulations should be prepared for excavation workers, and an inspection mechanism should be established.

Archaeological excavations are indispensable activities for both the preservation of cultural heritage and the production of scientific knowledge. However, due to the nature of fieldwork, excavation sites pose significant occupational health and safety risks. The findings of this study indicate that excavations should be approached not only in terms of their scientific outcomes but also through a systematic focus on the physical safety of workers.

The most common risks encountered during excavations include section collapses, accidents caused by heavy machinery, oxygen deficiency and methane accumulation, exposure to bacterial and viral agents, diseases transmitted by rodents, insect bites, allergic reactions, and respiratory problems. These risks demonstrate that archaeological fieldwork shares similarities with the construction sector in terms of hazards and, in some cases, is conducted under even less controlled conditions.

To mitigate risks and prevent fatal accidents, the following measures are essential:

- Risk assessment: Site-specific risk assessment forms should be prepared, completed by all team members, and updated regularly.
- Expert supervision: Each excavation should include an occupational health and safety specialist to oversee site arrangements, precautionary measures, and inspections.
- Record keeping: Accidents, injuries, and illnesses should be systematically recorded, reported, and analyzed.
- Training and preparedness: Team members should receive basic first aid training, emergency response plans should be developed, and appropriate communication systems must be established in accordance with field conditions.
- Personal protective equipment (PPE): The consistent use of gloves, masks, disinfectants, and respiratory protective equipment with filters should be mandatory.

The absence of a specific occupational health and safety regulation tailored to archaeological excavations in Türkiye represents a significant shortcoming. Special provisions must be introduced to ensure the safety of archaeologists, anthropologists, and workers at excavation sites. A legal framework should be developed with the contributions of the Ministry of Labour and Social Security, and an effective inspection mechanism should be implemented.

In conclusion, neglecting the risks associated with archaeological excavations may result not only in occupational accidents but also in disruptions to scientific research. Therefore, the integration of occupational health and safety practices into excavation processes must be regarded as essential for sustainable and secure fieldwork.

REFERENCES

1. Gökmeşe, E. Yıldız, H. (2018). İş Sağlığı ve Güvenliği. İstanbul: Lisans Yayıncılık.
2. Sharma, S., Nagar, A., Singh, L. P., & Singh, S. (2018). Occupational Hazards and Safety Measures for Archaeologists. Humanizing work and work Environment (HWWE 2016): English, 432.
3. Uzun, İ. Öztürk, D. & Gürcanlı, G. E. (2020). Mimari Restorasyon ve Konservasyon Projelerinde İşçi Sağlığı ve İş Güvenliği Uygulamaları. Teknik Dergi, 31 (5), 10275-10290.
4. HS2 Learning Legacy. (2004). Safety Health in Archeology, İngiltere.https://deohs.washington.edu/sites/default/files/images/general/archaeology_for_web.pdf). Erişim Temmuz 2025.
5. Özcan, E.K., D'alessandro, H.D., Batuk, M.Ö., Sennaroğlu, G. (2021). Gürültülü ortam çalışanlarında iş yaşamı ve genel yaşam kalitesinin ilişkisi. Turkish Journal of Audiology and Hearing Research, 4(3):78–85.
6. Çakar, M. (2024). Kimyasal Maddelerin Tehlikeleri ve İş Güvenliği Üzerindeki Etkileri. Kuzey Ege Teknik Bilimler ve Teknoloji Dergisi 1 (1), 46-56.
7. Gültaç, A.S., Ömür, N.G., Ağar, A. (2024). Laboratuvar Çalışanlarının İş Sağlığı ve Güvenliği Kapsamında Biyolojik Riskler Hakkında Algı Düzeylerinin Belirlenmesi. Gümüşhane Üniversitesi Sağlık Bilimleri Dergisi, 13(2), 850 – 859.
8. Langley, R. L., Abbott, J. (2000). Health and safety issues in archaeology: Are archaeologists at risk. North Carolina Archaeology, 49, 23-42.
9. Pala, E., Melikoğlu M. (2021). Kenelerden Kaynaklanan Hastalıklar. Derinin Paraziter Hastalıkları. Editörler: Serdaroğlu S, Kutlubay Z, 1. Baskı. Ankara, Türkiye Klinikleri, s.59-67.
10. Özkan, N.F., Kahya, E.(2017) Bir Üniversitenin İdari Ofislerindeki Ergonomik Risklerin Değerlendirilmesi. Journal of Faculty of Engineering and Architecture of Gazi University, 32(1), 141-150.
11. Salman, M. (2019). https://www.siirt.edu.tr/dosya/personel/isg-ders-notlari-siirt-201911415210516.pdf. İş Sağlığı ve Güvenliği. Erişim Tarihi: Temmuz 2025.
12. Ergör, A., (2014). İnternet: HAS 5030 Biyolojik ve Ergonomik Risk Etmenleri. Süleyman Demirel Üniversitesi Mühendislik Bilimleri ve Tasarım Dergisi, 3(3), 623-629.
13. Dinçer, B. (2012). Arkeolojik Arazi Çalışmalarında İş Güvenliği. Arkeoloji Gazetesi, 1-8. https://www.academia.edu/1815554/Arkeolojik_arazi_c_al%C4%B1s_malar%C4%B1nda_is_gu_venlig_i Erişim Tarihi: Temmuz 2025.
14. Şahin, D. (2019). Arkeoloji ve sanat tarihi nerede başlamalı, nerede bitmelidir? Uluslararası Türkçe Edebiyat Kültür Eğitim Dergisi, 8(4), 2399-2410.
15. Poirier, D. A, & Feder, K. L. (Eds.). (2000). Dangerous Places. Health, Safety, and Archaeology. Bloomsbury Publishing USA.
16. Klehm, C., Hildebrand E., Meyers M.S. (2021). Mitigating Chronic Diseases During Archaeological Fieldwork, Lessons from Managing Asthma, Diabetes, and Depression. Advances in Archaeological Practice, Published online by Cambridge University Press:11 March 2021. ISSN: 2326-3768 (Online). Editor: Allison Mickel The Georgia Institute of Technology, USA
17. Vamsi, V.N. (2023). Health and Safety Concerns in Excavation and the Measures to Mitigate Risk. International Journal for Research in Applied Science & Engineering Technology (IJRASET), ISSN: 2321-9653; 11 (3).
18. Kişisel Koruyucu Donanım Yönetmeliği, (2023). https://www.tse.org.tr/kisisel-koruyucu-donanim, Erişim Tarihi: Temmuz 2025
19. Demirtaş, A., Güngör, C. (2024). İnşaat Sektörü Çalışanlarının

Kişisel Koruyucu Donanımlar Hakkındaki Görüşleri. International Journal of Health and Applied Science, 2 (2).
20. Yetkin, A. (2021). Yüksek Lisans Tezi, Türkiye'de İş Kazalarına Bağlı Meslek Hastalıklarının Risk Boyutları Ve Korunmada Güncel Kişisel Koruyucu Donanımların Etkisi. KTO Karatay Üniversitesi LEE. YÖK Tez no: 704315.
21. Özdoğan, M. (2015) 50 Soruda Arkeoloji. Ezgi Matbaacılık, 19-94. Ege Yayınları, İstanbul.
22. https://www.cnnturk.com/turkiye/abd-vatandasi-olu-bulundu-72736 Erişim: Temmuz 2025.
23. https://isigmeclisi.org/9164-kibrista-profesor-arkeolog-is-kazasi-sonucu-oldu Erişim: Temmuz 2025.
24. https://www.klimik.org.tr/2022/06/09/kene-isirmasi-sonucu-hayatini-kaybeden-arkeolog-topraga-verildi
25. https://www.indyturk.com/tags/sinan-sertel Erişim: Temmuz 2025.
26. Fink, M.T., Zeitz, P.S. (2013). Hantavirus Pulmonary Syndrome and Field Archaeology: Guidelines for Risk Reduction. Journal of Field Archaeology, 23 (4), 471-476.

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Workplace Accidents in the Ready-Made Textile Sector and the Determination of Necessary Precautions Using the Fine-Kinney Method

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Workplace Accidents in the Ready-Made Textile Sector and the Determination of Necessary Precautions Using the Fine-Kinney Method

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Abstract

The textile industry is rapidly transforming with technological advancements and innovations in production methods, leading to an increase in production rates and intensified competition. However, this rapid progress also leads to a corresponding increase in workplace accidents. This study aims to identify the causes of workplace accidents in the textile industry and identify occupational health and safety measures that can be implemented to address these risks. Forty-eight different workplace accident reports were examined in detail, and field observations were conducted in two textile factories. Risks were analyzed using a Fine-Kinney risk assessment method. The findings reveal that the most significant threats within the industry are moving machinery and fire hazards. Furthermore, inadequate use of personal protective equipment, lack of occupational safety training, and inadequate fire safety measures were observed as recurring problems. To mitigate these risks, the study recommends mandatory use of PPE, implementation of machine guarding systems, regular fire drills, and comprehensive OSH training programs. The study also comprehensively examines other potential risks and the safety measures that should be taken to address them, concluding that with the appropriate precautions, loss of life and property can be largely prevented.

Keywords: Fine-Kinney method, work accidents, occupational health and safety, risk assessment, textile industry

Introduction

While the term textile narrowly refers to woven fabrics, when considered broadly, it also encompasses fibers, rovings, natural or handmade yarns, and various products produced from these materials. These products include a wide variety of textile products, from yarns and cords to ropes, woven and knitted fabrics, lace, and embroidery. This definition also includes home textiles (e.g., curtains, carpets, upholstery), knitted textiles, and fiber-based floor coverings made from woven yarns and fabrics. From another perspective, textiles define a multidimensional sectoral structure encompassing the raw materials used by fiber and roving producers, the technological processes by which these raw materials are processed, the equipment and structures used, production knowledge and skills, personnel, and related organizations working in the sector [1].

The textile sector, historically one of the oldest branches of production, encompasses a multi-stage production process that begins with the transformation of different types of fibers into yarn, then culminates in the combination of these yarns with specific patterns and colors to produce fabrics and, ultimately, the final product. This sector encompasses production areas using natural fibers such as cotton, wool, and silk, as well as synthetic and semi-synthetic yarns. The production scope encompasses a wide variety of materials, from cotton and wool fabrics to rayon and linen, cord fabric, hemp, and their derivatives. Sub-branches processing all of these materials include ready-made textile (garment) production and carpet weaving, both handmade and machine-made [2].

The textile and ready-made clothing industry in Turkey operates in various sub-production areas. The following subfields stand out:

- Cotton yarn production
- Cotton textile production
- Wool yarn production
- Wool textile production
- Artificial and synthetic yarn production
- Textile products produced from synthetic and artificial fibers
- Yarn and fabrics obtained from natural silk and artificial silk
- Knitwear and similar knitted textile products
- Ready-made clothing and apparel products
- Carpets, rugs, and similar home textile products
- Other textile products (e.g., accessories, technical textiles, etc.)

This diversity demonstrates the textile sector's versatile potential in both the local and export markets.

The textile sector is one of the areas requiring particular attention in terms of occupational health and safety. This is directly related to the diversity of production processes and the high number of employees within the sector. Garment workshops, in particular, employ a higher number of employees than other textile units in terms of manpower consumption, and women are also quite common in these businesses.

Garment businesses can be established quickly and have lower initial investment costs. However, despite these advantages, they also pose various occupational health risks. For example, repetitive hand movements can lead to ergonomic problems, and employees can experience fatigue-related accidents during overtime. Unregistered employment, low levels of automation, inadequate use of personal protective equipment, and inadequate training are among the other factors negatively impacting the occupational safety practices of these businesses. Considering all these factors, it is crucial to develop practically applicable safety policies specifically designed for the garment sector. Garment workshops are exposed to risks that can arise from various physical, chemical, and mechanical sources during production processes. These risk factors can be generalized as risks arising from moving parts, flammable and combustible materials, chemical risks, ergonomic risks, physical risks, risks related to falls from heights, risks resulting from slipping and tripping, risks arising

from auxiliary work equipment, risks from freight elevators, and risks arising from electrical components.

When examining the process of accidents, the "accident chain" model defined by Heinrich stands out. According to this model, accidents occur as a result of the sequential effects of five basic factors.

- Genetic and social environment,
- Personal shortcomings (such as carelessness, nervousness, recklessness, disregard, negligence),
- Unsafe actions and situations,
- Accidents,
- Injuries [3].

A study conducted on technical personnel revealed that 44.4% of workplace accidents were caused by unsafe working conditions, and 55.6% by unsafe behaviors [4]. This result indicates that the two most influential factors in the occurrence of accidents are unsafe conditions in the workplace (e.g., inadequate lighting, excessive noise) and unsafe behaviors of employees due to psychosocial factors (such as stress, fatigue, inattention).

A large portion of workplace accidents occur due to employees' failure to use personal protective equipment (PPE) or their careless behavior. Employees' understanding of the importance of PPE and their consistent use plays a significant role in reducing workplace accidents. Particularly in the textile industry, the use of head, ear, eye, respiratory, hand-arm, and body protective equipment is essential to protect against noise, mechanical effects, chemicals, and biological risks.

Workload, non-ergonomic equipment design, and lack of training increase the likelihood of errors in the occurrence of occupational accidents [5]. Furthermore, psychosocial factors such as stress, fatigue, time pressure, and excessive workload also increase the risk of accidents [6]. Recent empirical findings from the textile industry confirm that ergonomic deficiencies are among the most critical determinants of workplace accidents; Fine-Kinney-based analyses have identified musculoskeletal and machinery-related risks as priority hazards [7]. Inadequate protective measures, non-compliance with procedures, or employee disregard for these measures also contribute to the occurrence of occupational accidents [8].

When employees' physical and psychological capabilities are not considered, conditions such as fatigue and lack of motivation can lead to occupational accidents. While the goal of "zero accidents" for occupational accidents is a difficult ideal to achieve, it is essential for reducing the number of accidents [9].

A study conducted in Kenya demonstrated a strong correlation between occupational health and safety practices and job satisfaction [10]. Businesses should consider workplace accidents as an opportunity to recognize potential risks. Accurately identifying risk factors and taking the necessary precautions is essential for accident prevention. Therefore, prompt accident reporting and analysis are crucial.

It is known that there is a strong link between cheap labor and unsafe working conditions [11]. It is also emphasized that temporary (seasonal) workers carry a higher risk of accidents compared to permanent employees [12]. This situation is driven by factors such as low education levels, job insecurity, inexperience, frequent job changes, and negative impacts such as high income expectations [13]. It is known that the number of temporary workers in the textile sector is high.

Generally, the causes of occupational accidents are grouped according to internal and external factors of the employees, as seen in Table 1. Internal factors of the employees are considered to be the most common cause of accidents [14].

Material Method

Analyzed at two ready-made textile businesses in Çorum province, each with varying employee capacities, the goal was to increase production capacity between 2022 and 2025 while also achieving significant improvements in occupational health and safety (OHS). In this context, preventive strategies, both compliant with legislation and developed specifically for each business, should be implemented to reduce workplace accidents. Risk assessments were conducted for the businesses using the Fine-Kinney method, and efforts were planned to mitigate the resulting risks.

Fine-Kinney Risk Assessment Method

The Fine-Kinney method is a quantitative analysis approach that allows for the ranking of risks. Each hazard was evaluated based on probability, frequency, and severity parameters. While this study adopted the classic Fine-Kinney model, recent methodological advances suggest integrating fuzzy logic into the scoring system, which allows for more detailed risk prioritization and reduces subjectivity [15]. This demonstrates that the Fine-Kinney approach is continuously evolving and adaptable to different industrial contexts. In this method, each risk is evaluated according to three basic parameters:

- Probability (P): The likelihood of the hazard occurring,
- Frequency (F): The frequency of exposure to the hazard,
- Severity (S): The level of harm that would result if the hazard were to occur.

The risk value is calculated using the following formula:
Risk Score (R) = Probability (P) x Frequency (F) x Severity (S)
This method allows for the analysis of not only physical and technical risks but also organizational deficiencies. The data obtained from the review enabled the prioritization of risks and the determination of intervention strategies.

Significant Findings Obtained in the Field

The following significant risk elements were identified as a result of assessments conducted at two different apparel textile businesses:

Machine Safety: It has been observed that some machines with moving parts (e.g., lockstitch machines) on production lines lack adequate guards. This poses a serious risk of injury to employees.

Fire Safety: It has been observed that fire extinguishing equipment is either absent or unusable in some warehouse and storage areas. It has also been determined that fire drills are not conducted regularly.
OHS Training and Certification: It has been observed that some businesses do not provide occupational health and safety training or document this training. This is both a legal deficiency and a significant problem that can leave employees unprepared for hazards.
PPE Use: It has been observed that some employees do not regularly use personal protective equipment such as eyewear, gloves, or appropriate work shoes. This is another significant factor that increases the risk of workplace accidents.

Assessment and Implementation Steps

The steps followed within the Fine-Kinney analysis method are as follows:

- The main hazard sources present in each section of the workplace were identified.
- Possible hazards that could arise from these sources were identified through observation, surveys, and expert opinions.
- A risk analysis was conducted for each hazard.
- Preventive and corrective measures were determined for hazards identified as high-risk.
- Action plans were prepared to implement and monitor the identified measures.

The Fine-Kinney parameters used in the risk analysis process were classified as follows:

- Probability (P): 0.2 (very low) – 10 (very high)
- Frequency (F): 0.5 (infrequent exposure) – 10 (constant exposure)
- Severity (S): 1 (negligible harm) – 100 (fatal or catastrophic harm)

This systematic approach not only identified existing risks but also aimed to establish sustainable occupational health and safety policies to address these risks.

When determining probability, frequency and severity, the worst cases are evaluated, taking into account current operating conditions and controls.

Table 1. P – Probability is the probability that the harm will occur.

SCORE	PROBABILITY
0,2	Unexpected
0,5	Unexpected / But Possible
1	Possible But Unlikely
3	Possible
6	High / Very Possible
10	Definitely Could Happen One Day

Table 2. F – Frequency (frequency) of repeated exposure to the hazard over time

SCORE	FREQUENCY
10	Almost constantly (Several times an hour)
6	Frequently (Once a day or a few times)
3	Occasional (Once a week or a few times)
2	Infrequently (Once a month or a few times)
1	Infrequently (A few times a year)
0,5	Very rarely (Once a year or every few years)

Table 3. S – Severity – Potential Effects of Harm (Estimated Damage to Humans or the Environment)

SCORE	SEVERITY
1	Near miss / minor injury
3	Minor injury, Internal First Aid
7	Significant injury, External First Aid
15	Permanent injury, Loss of work, Occupational disease
40	Fatal accident
100	Multiple fatal accident

In the method used in Risk Assessment, scores of 70 and above have significant OHS impacts. Necessary actions are planned, implemented, and their effectiveness is monitored.

The A and B ready-made textile businesses operating in the province of Çorum, which were examined within the scope of the study, fall under NACE code 46.41 (wholesale trade - textile products) and are classified as “low hazard” workplaces. According to Occupational Health and Safety Law No. 6331 and related regulations, workplace hazard classes are determined according to NACE codes.

Risk assessments for workplaces classified as “low hazard” remain valid for six years, unless there are any significant changes. During this period, there must be no fundamental changes in the workplace’s area of activity, equipment used, work organization, or number of employees.

Risk assessments conducted using the Fine-Kinney method are generally prepared with a multidisciplinary approach, led by an occupational safety specialist. The risk scores obtained at the end of the assessment process are used to prioritize the necessary measures. Furthermore, these studies are of great importance for fulfilling legal obligations and preventing occupational accidents [16].

Findings

This section presents the field inspections and risk assessments conducted at two different ready-made textile businesses (A and B) operating in Çorum province. During the inspections, the businesses’ occupational health and safety practices were observed on-site, and potential hazard sources that could lead to occupational accidents were identified.

As part of the inspection, production areas, machinery, personnel organization, use of personal protective equipment (PPE), and occupational safety training for employees were

evaluated in detail. The risk factors identified because of these assessments were analyzed using the Fine-Kinney Risk Assessment Method.

Ready-made textile businesses A and B aimed to increase their production capacity between 2022 and 2025 while also making significant improvements in occupational health and safety (OHS). In this context, preventive strategies, both compliant with legislation and developed specifically for each business, were implemented to reduce occupational accidents. The measures to be taken at these two businesses are presented below.

Providing OHS training to employees
Providing basic OHS training to new employees during the orientation process. Employee knowledge and awareness play a significant role in preventing workplace accidents, as do technical measures. Therefore, providing occupational health and safety (OHS) training as part of orientation should be mandatory, especially for new employees. Orientation training is the first training process that allows new employees to become familiar with the workplace, corporate culture, duties and responsibilities, occupational safety rules, and the work environment.
The purpose of orientation training is:
- To accelerate the employee's orientation process,
- To increase internal communication and productivity,
- To provide information on legal and technical issues, particularly occupational health and safety,
- To ensure that employees begin their duties safely and consciously.

Orientation training generally covers the following topics:
- Introduction to the workplace (departments, managers, organizational structure),
- Job descriptions and responsibilities,
- Occupational health and safety rules (emergency exits, personal protective equipment, hazardous areas),
- First aid and emergency procedures,
- Work discipline rules and communication channels.

This training is generally provided upon recruitment and before starting work. It is a mandatory process, especially for occupational health and safety.

Expand the use of personal protective equipment (PPE)
Making the use of PPE mandatory and supervising it on the job is crucial for occupational safety. Simply providing PPE is not enough; its continuity and effectiveness are also critical for occupational safety. In practice, it is observed that some employees use protective equipment inadequately or incorrectly. To prevent such situations, regular inspections and monitoring should be conducted by occupational safety experts or authorized personnel. PPE use should be monitored in a disciplined manner. In cases where deficiencies are detected, employees should be warned, and sanctions should be implemented for repeated violations. This approach not only contributes to the protection of employees but also helps employers fulfill their legal responsibilities.

Equipment such as gloves, earplugs, goggles, nose and mouth masks, and steel-toed work boots should be provided in full, according to the number of employees. Workers in the textile industry are exposed to numerous physical and chemical risks during the production process. These risks include needle sticks, contact with sharp objects, dust and thread particles entering the eyes, and falls from slippery surfaces. Therefore, personal protective equipment (PPE) should not only be recommended but also mandatory in the workplace. Gloves prevent cuts or punctures; goggles prevent foreign objects from entering the eyes; non-slip shoes reduce the risk of falls; and work clothing protects the skin from chemical and mechanical hazards. It is the employer's responsibility to ensure that this equipment complies with standards and is provided to every employee.

Machine safety and technical measures
A significant portion of occupational accidents in the textile industry stem from machinery-related hazards. Therefore, the effective implementation of regulations for the safe use of machinery used in production is crucial. Safety sensors detect hazardous situations in machinery and prevent potential accidents. However, in some cases, these systems are observed to be intentionally disabled. This poses a serious risk to both occupational health and safety.

Periodic machine maintenance is essential to prevent occupational accidents caused by wear, malfunctions, and breakdowns. Furthermore, implementing systems that require two-handed operation, especially on machines with cutting, compressive, or rotating moving parts, directly contributes to accident prevention. Such safety systems prevent workers from operating the machine without using both hands simultaneously, thus preventing hand injuries.

Reducing psychosocial risks
Paying Attention to Rest Periods: When planning shift systems, care should be taken to ensure that employees receive adequate rest periods, and a work-life balance should be maintained.

Reducing Excessive Workload: Employees should not be assigned tasks beyond their capacity, and a balanced distribution of tasks should be ensured.
Avoiding long working hours: Daily and weekly working hours should be kept within legal limits, and overtime should be limited to exceptional circumstances.

Organizing shift rotations: Adequate sleep and rest periods should be allowed between shifts, and transitions between day and night shifts should be planned gradually.

Minimizing stress factors: Sources of psychological stress, such as communication problems, uncertainty, and pressure, should be identified in the workplace, and necessary improvements should be made.

Ergonomic improvements
Ergonomic arrangement of workspaces: Desk heights, chair configurations, and standing areas should be adjusted according to ergonomic standards to protect employee health.

Reducing repetitive movements: To prevent musculoskeletal disorders, workstations should be designed to minimize repetitive movements that strain employees.

Audit and performance monitoring
Conducting regular OHS audits: Conducting internal audits at regular intervals by the occupational health and safety (OHS) unit allows for the early detection of risks.

Reporting accidents and near-miss incidents: Employees should be encouraged to voluntarily report incidents; The data obtained should be analyzed and reported to senior management.

Emergency action plans
Periodic emergency drills: Regular drills should be conducted to be prepared for potential emergencies such as fires, power outages, and chemical leaks.

Providing hands-on training: Awareness should be raised by providing hands-on training to all employees on the use of fire extinguishers, emergency exit routes, and assembly areas.

Developing an OSH culture
Sharing achievements and establishing a reward system: Sharing achievements in occupational health and safety with all employees and establishing reward systems that encourage these achievements promotes OSH awareness.

Increasing employee participation through feedback mechanisms: Collecting workers' opinions and suggestions through tools such as suggestion boxes, surveys, and employee satisfaction forms increases participation in OSH practices and encourages ownership.

Occupational accidents that occurred in A and B apparel textile enterprises, where potential risks were identified according to the Fine-Kinney risk assessment method and measures were taken to mitigate these risks as described above, are shown in Figures 1-3, by year.

How Can Workplace Accidents Be Prevented in Textile Enterprises?

Textile enterprises are workplaces with a high probability of many workplace accidents due to the risks they pose. A key aspect of the study is the recommendation of preventive measures. Recommendations for reducing existing risks for ready-to-wear textile enterprises include:

-Use of personal protective equipment (PPE)
-Machine safety and maintenance
-Training and awareness-raising
-Risk assessment and remediation
-Health surveillance, monitoring, and preparation of emergency plans.

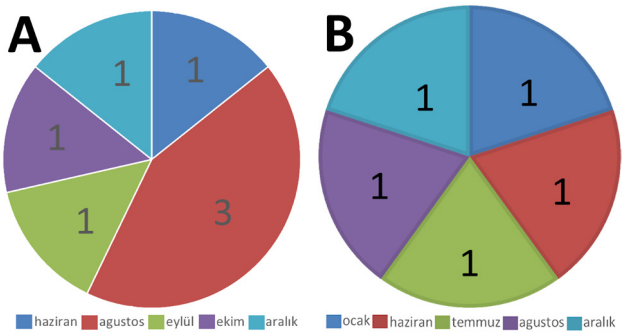

Figure 1. Work accidents in A and B ready-made garment textile enterprises in 2022 according to Social Security Institution (SSI) data

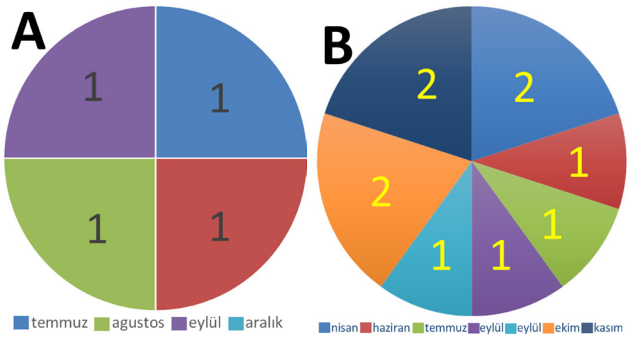

Figure 2. Work accidents in A and B ready-made garment textile enterprises in 2023 according to SSI data

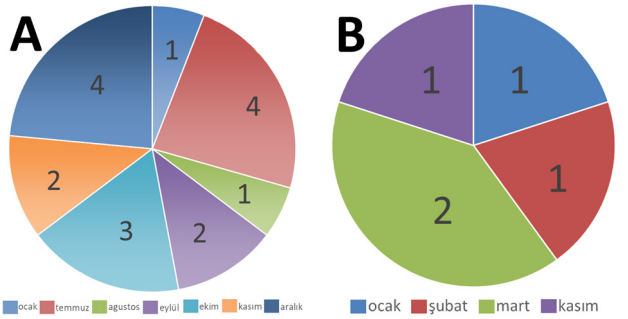

Figure 3. Work accidents in A and B ready-made garment textile enterprises in 2023 according to SSI data.

Conclusion and Recommendations

This thesis analyzes frequently encountered occupational accidents in the textile industry in detail, and systematically identifies their root causes. Field investigations and report analyses demonstrate that recurring risk factors in the industry are structured around specific patterns and are largely preventable. Based on the 48 occupational accident reports examined and on-site assessments conducted at two separate businesses, the most common risks in the industry were determined to be:

- Lack of protective systems in machinery and equipment,
- Inadequate precautions in fire-prone areas,
- Physical hazards such as falls from heights, slips, and trips,
- Uncontrolled use of chemical substances,
- Indiscriminate use of auxiliary equipment (e.g., forklifts and cranes),
- Serious structural deficiencies in electrical systems.

The findings reveal that occupational accidents are caused not only by technical equipment deficiencies but also by low employee awareness. Similar patterns have been reported in other industrial contexts. For example, [17]. Demir et al. (2024) conducted a Fine-Kinney risk assessment at a hazardous waste management facility and demonstrated that both technical deficiencies and organizational cultural factors contribute to accident frequency. The findings of this study align with those of the study by Demir et al. (2024), highlighting the cross-sectoral importance of promoting a strong safety culture in addition to technical controls. Therefore, it is clear that an occupational safety culture must be supported not only by legislation but also by training, inspections, and workplace policies.

Based on the findings of this study, the following recommendations have been developed to increase occupational health and safety in the textile industry:

1. Training and awareness campaigns should be expanded: Occupational health and safety training should be provided to employees before starting work and at regular intervals. Training should not be limited to theoretical knowledge; it should be supplemented with practical and industry-specific content.
2. The use of personal protective equipment (PPE) should be made mandatory: The supply, use, and maintenance of PPE should be the responsibility of the employer, and systematic follow-up should be conducted in cases of deficiencies. Furthermore, employees should be clearly explained why and how they should use this equipment.
3. Safety standards for machinery and equipment should be improved: The lack of protective systems in older model machinery is a common problem. Equipping or replacing these machines with modern safety systems should be encouraged.
4. Fire safety practices should be reviewed: Fire drills should be conducted regularly in all workplaces, extinguishing systems appropriate to the type of material should be selected, and the functionality of firefighting equipment should be continuously monitored.
5. Precautions regarding working at heights should be increased: High platforms should be equipped with guardrails and fall arrest systems; Employees should be taught safe climbing and working techniques.
6. Risk assessments should be ongoing: Systematic analyses, such as the Fine-Kınney risk assessment method, should be repeated regularly, not just during the initial installation phase. This allows for rapid response to changing conditions.
7. Inspections and sanctions should be made more effective: When violations of occupational health and safety practices are detected, more deterrent sanctions should be implemented; the frequency of inspections should be increased. The fight against unregistered employment should also be addressed within this framework.
8. Increasing safety culture: One of the main causes of occupational accidents in the textile sector is employees' inadequate compliance with occupational safety rules and poor safe behavioral habits. This can be prevented not only through technical measures but also by developing a safety culture that encompasses the entire organizational structure. Safety culture is a holistic approach shaped by the safety-related values, attitudes, and behaviors of all individuals in the workplace (Cooper, 2000).

The following suggestions can be made to improve safety culture.

- Continuous and practical training: Employees should be provided with practical, behavior-focused training that goes beyond simply providing theoretical knowledge. Such training increases risk awareness and encourages safe behaviors [18].
- Managerial commitment and role model behaviors: The importance placed on safety by senior management has a direct impact on employees. Managers' role modeling ensures the adoption of safe behaviors throughout the organization [19].
- Feedback and participation mechanisms: Employees should be encouraged to express their opinions on safety issues and actively participate in the process. Furthermore, reward systems that support safe behaviors also increase motivation [20].
- Proactive control systems: Instead of focusing solely on post-accident interventions, control systems should be implemented that focus on identifying potential risks in advance and reinforcing safe behaviors.
- Integration into corporate philosophy: A safety culture should be instilled in all employees with the understanding that "safety is an individual responsibility," and this principle should be made one of the organization's core values.

In businesses with a strong safety culture, the frequency of workplace accidents decreases, while productivity, employee satisfaction, and workplace loyalty increase. Therefore, occupational health and safety strategies should be addressed not only within the framework of legal obligations but also from a cultural transformation perspective [21].

Implementing the suggestions presented above will contribute to a significant reduction in workplace accidents in the textile sector. These recommendations align with recent international applications of the Fine-Kinney method, where systematic monitoring combined with ergonomic improvements and automation has been shown to significantly reduce accident rates [7,17]. Therefore, this current study not only provides industry-specific insights but also aligns with global best practices in occupational health and safety. The tables obtained using the Fine-Kinney risk assessment method, which was used to identify the risks of two different ready-made textile businesses evaluated within the scope of this thesis and to reduce their risk scores, are presented in the appendix.

References

1. Gürsoy, H. (2000). İnsan gücünün üretimdeki rolü ve verimliliğe etkisi: Tekstil sektörü örneği. Ankara: Nobel Yayıncılık.
2. Aruoba, S. (1999). Risk, belirsizlik ve öngörülemeyen üzerine yazılar. Ankara: İmge Kitabevi.
3. Cleveland State University. (2016). *Accident chain model*. *Safety Science Journal*, 12(3), 45-52.
4. Aybek, A., Yılmaz, F., & Demir, M. (2003). İş kazalarında güvenli olmayan davranışların analizi. İş Sağlığı ve Güvenliği Dergisi, 12(2), 45–52.

5. Lardner, R., & Scaife, R. (2006). Helping Engineers to Analyse and Influence the Human Factors in Accidents at Work. Process Safety and Environmental Protection, 84(3), 179–183. DOI: 10.1205/PSEP.05188.Kirschenbaum, A., et al. (2000). Worker behavior and accident risk: Evidence from organizational psychology. Safety Science, 36(3), 123–139.
6. Ofili, A. N., et al. (2003). Occupational health hazards in the workplace: A study of Nigeria textile industry. Nigerian Journal of Clinical Practice, 6(1), 10–15.
7. Aslan, I., Hamitoğlu, F., Acar, N., & Acar, H., 2025. Risk assessment of ergonomic factors in a textile firm by RULA, REBA, and Fine-Kinney methods. Ergonomics International Journal, 9(1), 000340. https://doi.org/10.23880/eoij-16000340
8. Pedroso-Gonçalves, L., et al. (2008). Environmental and psychosocial risk factors in workplace accidents. Occupational Health Review, 30(3), 145–155.
9. Omusulah, M. (2013). The impact of occupational health and safety programs on employee job satisfaction. Journal of Emerging Trends in Economics and Management Sciences, 4(2), 231–237.
10. Kirschenbaum, A., Oigenblick, L. ve Goldberg, A. I. (2000). Well-being, work environment and accident risk. *Safety Science*, 36(3), 239–254.
11. Guadalupe, M. (2003). Temporary workers and occupational safety. *Journal of Labor Studies*, 8(2), 112-130.
12. Hintikka, N. (2011). Accidents at work in relation to work and organizational factors. Finnish Institute of Occupational Health Reports, 45(1), 21–35.
13. Mbaye, S., & Kouabenan, D. (2013). Analysis of the causes of work accidents. *Safety Science*, 55, 178-187.
14. Ministry of Labor and Social Security. (2024). List of hazard classes according to NACE code. Access address: https://www.csgb.gov.tr [Access date: 14.07.2025].
15. Över Özçelik, T., Yilmaz Yalciner, A., Cetinkaya, M., & Aker, A. (2025). Risk assessment with the fuzzy Fine–Kinney method in a business operating in the metal industry. International Journal of Occupational Safety and Ergonomics, 31(1), 308–317. https://doi.org/10.1080/10803548.2024.2438562
16. Cooper, M. D. (2000). Towards a model of safety culture. Safety Science, 36, 111–136. https://doi.org/10.1016/S0925-7535(00)00035-7
17. Demir, G., Ersöz, M., Özcan, H. K., & Demir, Y. (2024). Occupational health and safety in a hazardous waste disposal facility using Industry 4.0 technologies: Fine Kinney risk analysis. Front Life Sci RT, 5(3), 195–202, doi.org/10.51753/flsrt.1498808
18. Guldenmund, F. W. (2000). The nature of safety culture: A review of theory and research. Safety Science, 34(1–3), 215–257. https://doi.org/10.1016/S0925-7535(00)00014-X
19. Zohar, D. (1980). Safety climate in industrial organizations: Theoretical and applied implications. Journal of Applied Psychology, 65(1), 96–102. https://doi.org/10.1037/0021-9010.65.1.96
20. Neal, A. ve Griffin, M. A. (2006). A study of the relationships among safety climate, safety practices, and safety outcomes. *Human Factors*, 48(3), 451–461.
21. Reason, J. (1997). *Managing the risks of organizational accidents*. Aldershot: Ashgate Publishing.

Suplemantary File

S1. Fine Kinney Tabloları

PREPARATION DATE : REVISION DATE : VALIDITY DATE :	RISK ANALYSIS FOR A AND B TEXTILE COMPANIES	FORM NO : ISSUE DATE : REV NO / DATE :

Probability Value	Description
10	Certain / Expected
6	Highly Likely
3	Likely
2	Possible but Low
1	Unlikely but Possible
0,5	Unexpected / Not Expected

Frequency Value	Description
10	Several times per hour
6	Once or several times a day
3	Once or several times a week
2	Once or several times a month
1	Several times a year
0,5	Once a year or less frequently

Severity Value	Description
100	Multiple Fatal Accidents
40	Fatal Accident
15	Permanent Damage, Work Loss
7	Significant Damage, External First Aid
3	Minor Damage, Internal First Aid
1	Near Miss

Risk Value	Risk Assessment Result
R>400	Work must be stopped and immediate action must be taken
200<R<400	Very critical, should be included in the action plan
70<R<200	Significant, should be included in the action plan and monitored
20<R<70	Should be included in the action plan and kept under observation
R<20	Not a priority, may not be included in the action plan

TABLE FOR DETERMINING RISK LEVELS ACCORDING TO HAZARDS											CORRECTIVE AND PREVENTIVE ACTION IDENTIFICATION TABLE								
SERIAL NO	DEPARTMENT/ ACTIVITY	DESCRIPTION OF HAZARD	RISK	PEOPLE AFFECTED	LEGAL BASIS	PROBABILITY	FREQUENCY	SEVERITY	RISK VALUE	RISK DEFINITION	RECOMMENDED IMPROVEMENTS	RESPONSIBLE PERSON	DEADLINE	PROBABILITY	FREQUENCY	SEVERITY	RISK VALUE	RISK DEFINITION	REMARKS
1	WORKING IN THE ENVIRONMENT	Absence of residual current device (RCD)	Injury/death due to electric shock	All employees / visitors	Occupational Health and Safety Law	3	1	40	120	Significant Risk	A 300-mA residual current device must be installed on the main panel, and a 30-mA residual current device must be installed on the sub-panels, and they must be actively functioning.	Employer	Continuous	0,5	1	40	20	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
2	WORKING IN THE ENVIRONMENT	Lack of grounding for electrically operated machines and equipment	Injury/death due to electric shock	All employees / visitors	Occupational Health and Safety Law	3	1	40	120	Significant Risk	Machines must be visibly mounted with body grounding.	Employer	Continuous	0,5	1	40	20	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
3	WORKING IN THE ENVIRONMENT	Failure to inspect the electrical installation	Injury/death due to electric shock	All employees / visitors	Occupational Health and Safety Law	3	1	40	120	Significant Risk	Electrical installations must be inspected at least once a year by authorized people or organizations, and any deficiencies identified in the inspection report must be rectified. The report must be archived in the occupational health and safety file.	Employer	Continuous	0,5	1	40	20	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
4	WORKING IN THE ENVIRONMENT	Lack of periodic inspection of the lightning rod	Injury/death due to electric shock	All employees / visitors	Occupational Health and Safety Law	3	1	40	120	Significant Risk	Lightning conductors must be inspected at least once a year by authorized people or organizations, and any deficiencies identified in the inspection report must be rectified. The report must be archived in the occupational health and safety file.	Employer	Continuous	0,5	1	40	20	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.

5	WORKING IN THE ENVIRONMENT	Absence of warning signs related to the electrical installation	Injury/death due to electric shock	All employees / visitors	Occupational Health and Safety Law	3		2	15	90	Significant Risk	Any missing items should be completed and hung in the appropriate places, and a control system should be established.	Employer	Continuous	0,5		2	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
6	WORKING IN THE ENVIRONMENT	Electrical panel covers being open and fuses being unprotected	Injury/death due to electric shock	All employees / visitors	Occupational Health and Safety Law	3		1	40	120	Significant Risk	Panel covers shall be kept closed and locked, fuses shall be protected and regularly inspected, and warning signs shall be posted. The name and contact information of the authorised person shall be written on the panel covers. Unauthorised people shall be prevented from interfering.	Employer	Continuous	0,5		1	40	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
7	WORKING IN THE ENVIRONMENT	Electrical panel front being obstructed	Injury/death due to inability to respond to emergencies	All employees / visitors	Occupational Health and Safety Law	3		1	40	120	Significant Risk	The front of electrical panels must be cleared, and a control mechanism must be established to ensure that it is always empty.	Employer	Continuous	0,5		1	40	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
8	WORKING IN THE ENVIRONMENT	Lack of grounding for the electrical panel body	Injury/death due to electric shock	All employees / visitors	Occupational Health and Safety Law	3		1	40	120	Significant Risk	The electrical panel body must be grounded.	Employer	Continuous	0,5		1	40	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
9	WORKING IN THE ENVIRONMENT	Absence of internal protective cover in the electrical panel	Injury/death due to electric shock	All employees / visitors	Occupational Health and Safety Law	3		1	40	120	Significant Risk	An internal protective sheet must be installed in the electrical panel.	Employer	Continuous	0,5		1	40	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
10	WORKING IN THE ENVIRONMENT	Electrical cables are scattered, worn and spliced	Injury/death due to electric shock, tripping, or falling	All employees / visitors	Occupational Health and Safety Law	3		1	40	120	Significant Risk	Old, worn-out and attached cables in the work environment should be replaced, and scattered cables should be collected. A control mechanism should be established to ensure that cables are always kept tidy. Cables should be routed through cable ducts to prevent them from being crushed or worn out.	Employer	Continuous	0,5		1	40	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
11	WORKING IN THE ENVIRONMENT	Wet or damp surroundings of panels, sockets, switches, exposed cables, electric hand tools, electric machines, etc.	Injury/death due to electric shock	All employees / visitors	Occupational Health and Safety Law	3		1	40	120	Significant Risk	Panels, sockets, switches, exposed cables, electrical household appliances, electrical machines, etc. should not be kept in wet or damp areas.	Employer	Continuous	0,5		1	40	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.

12	WORKING IN THE ENVIRONMENT	Compressor, air tank, and steam boiler	Overheating, explosion, shrapnel effect, fire	All employees / visitors	Occupational Health and Safety Law	3	1	40	120	Significant Risk	The compressor's air tanks must be ventilated against explosion and located within a sturdy compartment. Safety valves and pressures must be checked continuously. Unauthorized people must be prevented from interfering.	Employer	Continuous	0,5	1	40	20	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
13	WORKING IN THE ENVIRONMENT	Lack of insulating mat suitable for panel voltage in front of the electrical panel	Injury/death due to electric shock	All employees / visitors	Occupational Health and Safety Law	3	1	40	120	Significant Risk	Insulating mats of appropriate width should be placed in front of the panels, and work should be carried out on the mats.	Employer	Continuous	0,5	1	40	20	Low Risk	This risk value willnot be reduced further, and controls will continue to be
14	WORKING IN THE ENVIRONMENT	Damaged and scattered extension cables in the working area	Injury/death due to electric shock, tripping, or falling	All employees / visitors	Occupational Health and Safety Law	3	1	40	120	Significant Risk	Damaged extension cables should not be used in the workplace, and cable extensions should not be scattered on the floor. Worn cables with exposed ends should not be used.	Employer	Continuous	0,5	1	40	20	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
15	WORKING IN THE ENVIRONMENT	Use of non-original fuses bypassed with wire	Injury/death due to electric shock	All employees / visitors	Occupational Health and Safety Law	3	1	40	120	Significant Risk	Non-original fuses that have been bridged with wire should not be used.	Employer	Continuous	0,5	1	40	20	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
16	WORKING IN THE ENVIRONMENT	Lack of labels indicating controlled areas on fuses, switches, and circuit breakers on the panel or board	Injury/death due to electric shock	All employees / visitors	Occupational Health and Safety Law	3	1	40	120	Significant Risk	Labels indicating the location controlled by the insurance switches and keys on the table or panel must be provided.	Employer	Continuous	0,5	1	40	20	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
17	WORKING IN THE ENVIRONMENT	Failure to use Personal Protective Equipment (PPE) in electrical work	Injury/death due to electric shock	All employees / visitors	Occupational Health and Safety Law	3	1	40	120	Significant Risk	Personal protective equipment must be used and monitored when working with electricity.	Employer	Continuous	0,5	1	40	20	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
18	WORKING IN THE ENVIRONMENT	Lack of basic electrical safety training for all employees	Injury/death due to electric shock	All employees / visitors	Occupational Health and Safety Law	3	1	40	120	Significant Risk	All employees must be informed about the dangers, risks and actions to be taken in emergency situations during electrical work.	Employer	Continuous	0,5	1	40	20	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.

19	WORKING IN THE ENVIRONMENT	Performing maintenance on live electrical installations	Injury/death due to electric shock	All employees / visitors	Occupational Health and Safety Law	3	1	40	120	Significant Risk	Repairs should never be carried out on electrical installations while they are alive. Maintenance and repairs should be carried out after disconnecting the main power supply, and there must be a locking system in place at the main power switch, or a personmust be assigned to monitor it.	Employer	Continuous	0,5	1	40	20	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
20	WORKING IN THE ENVIRONMENT	Use of electric water heaters, stoves, etc.	Injury/death due to fire	All employees / visitors	Occupational Health and Safety Law	3	1	40	120	Significant Risk	The cables of heaters, stoves, etc. used in the workplace must have proper insulation, the plug must be unplugged at the end of work, and electrical installations that have not been tidied up must not be used.	Employer	Continuous	0,5	1	40	20	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
21	WORKING IN THE ENVIRONMENT	Generation of static electricity	Injury/death due to electric shock, fire, or explosion	All employees / visitors	Occupational Health and Safety Law	3	1	40	120	Significant Risk	Systems that prevent static electricity build-up should be installed in the workplace.	Employer	Continuous	0,5	1	40	20	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
22	WORKING IN THE ENVIRONMENT	Inability to intervene in fire due to lack of fire extinguisher	Injury/death due to fire	All employees / visitors	Occupational Health and Safety Law	3	2	15	90	Significant Risk	Fire extinguishers will be completed and inspected. The electrical panel room must have a CO2 fire extinguisher, and the kitchen area must have a CO2 or foam fire extinguisher.	Employer	Continuous	0,5	2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
23	WORKING IN THE ENVIRONMENT	Inability to intervene in fire due to the fire extinguisher not being filled	Injury/death due to fire	All employees / visitors	Occupational Health and Safety Law	3	2	15	90	Significant Risk	Fire extinguishers must be inspected monthly, and periodic inspection dates must be tracked to ensure that they are refilled and tested.	Employer	Continuous	0,5	2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
24	WORKING IN THE ENVIRONMENT	Delayed fire response due to materials placed in front of the fire extinguisher	Injury/death due to fire	All employees / visitors	Occupational Health and Safety Law	3	2	15	90	Significant Risk	Fire extinguishers should be kept clear of obstructions and monitored accordingly. They shall be hung at a maximum height of 90 cm above the floor. Fire extinguishers shall be numbered and the number and instructions for use shall be displayed in a visible place.	Employer	Continuous	0,5	2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
25	WORKING IN THE ENVIRONMENT	Failure to number fire extinguishers, create a list, and maintain regular tracking, resulting in delayed fire response	Injury/death due to fire	All employees / visitors	Occupational Health and Safety Law	3	2	15	90	Significant Risk	Fire extinguishers will be numbered, and a list will be created.	Employer	Continuous	0,5	2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.

26	WORKING IN THE ENVIRONMENT	Lack of signage showing the location of fire extinguishers, causing employees not to know their locations, leading to delayed fire response	Injury/death due to fire	All employees / visitors	Occupational Health and Safety Law	3	2	15	90	Significant Risk	Missing information signs shall be installed.	Employer	Continuous	0,5	2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
27	WORKING IN THE ENVIRONMENT	Inappropriate type of fire extinguisher for area of use (e.g., Dry Powder, CO_2, Halocarbon), resulting in failure to extinguish the fireand its spread	Injury/death due to fire	All employees / visitors	Occupational Health and Safety Law	3	2	15	90	Significant Risk	The control mechanism to be established will ensure that fire extinguishers are of the appropriate type for their area of use.	Employer	Continuous	0,5	2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
28	WORKING IN THE ENVIRONMENT	Insufficient number of fire extinguishers for the relevant hazard class, preventing effective intervention	Injury/death due to fire	All employees / visitors	Occupational Health and Safety Law	3	2	15	90	Significant Risk	Once the list of fire extinguishers has been compiled, calculations will be made to determine whether the number of extinguishers is sufficient for the existing workplace area. If it is not sufficient, thenecessary additions will be made.	Employer	Continuous	0,5	2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
29	WORKING IN THE ENVIRONMENT	Fire extinguishers not mounted at appropriate height on the wall	Injury/death due to fire	All employees / visitors	Occupational Health and Safety Law	3	2	15	90	Significant Risk	Fire extinguishers weighing more than 2 kg and less than 12 kg shall be mounted on the wall at a maximum height of 90 cm from the floor.	Employer	Continuous	0,5	2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
30	WORKING IN THE ENVIRONMENT	Lack of signage showing the location of fire hose cabinets, causing employees not to know their locations, leading to delayed fire response	Injury/death due to fire	All employees / visitors	Occupational Health and Safety Law	3	1	40	120	Significant Risk	Any missing information signs must be completed. Instructions for use of the fire extinguishing system must be posted.Firefighting equipment must be inspected at least once a year by an authorised person or institution. Any deficiencies identified in the report must be rectified immediately. Thereport must be archived in the OHS file.	Employer	Continuous	0,5	1	40	20	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
31	WORKING IN THE ENVIRONMENT	Materials placed in front of fire cabinet, causing delayed fire response	Injury/death due to fire	All employees / visitors	Occupational Health and Safety Law	3	2	15	90	Significant Risk	Materials in front of the fire extinguisher cabinet will be removed, and this will be maintained on an ongoing basis.	Employer	Continuous	0,5	2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
32	WORKING IN THE ENVIRONMENT	Absence of fire alarm button and siren causing delay in communicating emergencies to other employees	Injury/death due to fire	All employees / visitors	Occupational Health and Safety Law	3	1	40	120	Significant Risk	A fire alarm button is available. In case of malfunction, it should be repaired immediately and checked periodically.	Employer	Continuous	0,5	1	40	20	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.

33	WORKING IN THE ENVIRONMENT	Failure to inspect and report fire alarm button and siren periodically, causing them not to work when needed	Injury/death due to fire	All employees / visitors	Occupational Health and Safety Law	3			120	Significant Risk	Periodic inspections should be carried out by authorised people at intervals specified in the standards and should be recorded.	Employer	Continuous	0,5			40		20	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
34	WORKING IN THE ENVIRONMENT	Failure to post fire-related instructions in required areas	Injury/death due to delayed fire response	All employees / visitors	Occupational Health and Safety Law	3	2		90	Significant Risk	Fire safety instructions should be posted in the appropriate places and be easily accessible.	Employer	Continuous	0,5			15		15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
35	WORKING IN THE ENVIRONMENT	Absence of fire detection and alarm systems	Injury/death due to delayed fire response	All employees / visitors	Occupational Health and Safety Law	3	1		120	Significant Risk	Fire detection systems must be installed in accordance with building fire protection regulations.	Employer	Continuous	0,5			40		20	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
36	WORKING IN THE ENVIRONMENT	Absence of fire blanket	Injury/death due to delayed fire response	All employees / visitors	Occupational Health and Safety Law	3	1		45	Possible Risk	There should be a fire blanket in the kitchen, and it should be located in a place that is easily accessible to kitchen staff.	Employer	Continuous	0,5	1		15		7,5	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
37	WORKING IN THE ENVIRONMENT	Failure to have ventilation system inspected	Injury/death due to delayed fire response	All employees / visitors	Occupational Health and Safety Law	3	1	15	45	Possible Risk	The ventilation system must be inspected at least once a year. Any deficiencies identified in the report must be rectified and the report must be archived in the occupational health and safety file.	Employer	Continuous	0,5	1		15		7,5	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
38	WORKING IN THE ENVIRONMENT	Failure to conduct fire drills and provide fire safety training	Injury/death due to fire	All employees / visitors	Occupational Health and Safety Law	3	1	15	45	Possible Risk	A fire drill was conducted as an emergency drill. Emergency drills must be conducted at least once a year.	Employer	Continuous	0,5	1		15		7,5	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
39	WORKING IN THE ENVIRONMENT	Presence of unprotected moving parts in machines	Injury / death caused by moving machine parts	All employees / visitors	Occupational Health and Safety Law	3	2	15	90	Significant Risk	Machine guards should be installed where possible, and trained personnel should be assigned to work with appropriate personal protective equipment where this is not possible. Belts, pulleys and chain systems should not be exposed. Hands and armsshould not be inserted.	Employer	Continuous	0,5	2		15		15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.

40	WORKING IN THE ENVIRONMENT	Machine guards are not fixed and can be easily removed.	Injury / death caused by machine guards being disabled	All employees / visitors	Occupational Health and Safety Law	3	2	15	90	Significant Risk	Before starting the machines, check the guards and make sure they are securely in place.	Employer	Continuous	0,5	2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
41	WORKING IN THE ENVIRONMENT	Material falling into the moving parts of the machine while it is operating	Damage, injury, or death caused by material falling onto a moving part	All employees / visitors	Occupational Health and Safety Law	3	2	15	90	Significant Risk	The area around the machines must always be kept clean and tidy, free of unnecessary materials, and this must be maintained on an ongoing basis.	Employer	Continuous	0,5	2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
42	WORKING IN THE ENVIRONMENT	Machine maintenance has not been done	Injury / death due to problems in machines that are not maintained	All employees / visitors	Occupational Health and Safety Law	3	2	15	90	Significant Risk	Machine maintenance should be carried out at regular intervals and recorded using machine maintenance forms. The power should be turned off during machine maintenance and repairs and should not be turned on until maintenance and repairs are complete.	Employer	Continuous	0,5	2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
43	WORKING IN THE ENVIRONMENT	Lack of operating instructions for machinery and equipment	Injury, limb loss	All employees	Occupational Health and Safety Law	3	2	15	90	Significant Risk	The instructions for use of machinery and equipment must be written. Employees must be trained on the hazards and risks that may arise during the use of machinery, and training records must be kept.	Employer	Continuous	0,5	2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
44	WORKING IN THE ENVIRONMENT	Switches and controls operate the machine spontaneously and with impact effect.	Injury / death	All employees / visitors	Occupational Health and Safety Law	3	2	15	90	Significant Risk	Switches and control buttons shall be designed and constructed in such a way that they cannot be activated accidentally or by impact and shall be located in a position that is easily accessible to the worker.	Employer	Continuous	0,5	2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
45	WORKING IN THE ENVIRONMENT	There is no machine emergency stop button	Injury / death	All employees / visitors	Occupational Health and Safety Law	3	2	15	90	Significant Risk	Emergency stop buttons must be installed on machines to enable intervention in emergency situations, and these buttons must be in working order. Personnel must be informed about the emergency stop buttons.	Employer	Continuous	0,5	2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
46	WORKING IN THE ENVIRONMENT	Lack of a spotter along with the personnel responding to the machine malfunction	Injury / death	All employees / visitors	Occupational Health and Safety Law	3	2	15	90	Significant Risk	After any malfunction, workers who enter the machine to intervene should be monitored by a guard to prevent the machine from starting, and the necessary warning signs should be posted.	Employer	Continuous	0,5	2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.

47	WORKING IN THE ENVIRONMENT	Lack of adequate warnings and instructions on the production side	Injury / death	All employees / visitors	Occupational Health and Safety Law	3	2	15	90	Significant Risk	The necessary warnings and instructions should be posted in the production area to inform employees about this matter.	Employer	Continuous	0,5	2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
48	STAIN REMOVAL PROCESS	The chemicals used in stain removal do not have a material safety data sheet (MSDS)	Lack of knowledge of first aid measures	All employees	Occupational Health and Safety Law	3	1	40	120	Significant Risk	MSDSs for the chemicals used must be requested from the supplier. Employees must be informed. MSDS forms must be posted in the stain room.	Employer	Continuous	0,5	1	40	20	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
49	STAIN REMOVAL PROCESS	Lack of specific personnel for stain removal	Occupational disease	All employees	Occupational Health and Safety Law	3	1	40	120	Significant Risk	The person who will be working on the transaction must be determined on a permanent basis.	Employer	Continuous	0,5	1	40	20	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
50	STAIN REMOVAL PROCESS	Lack of training and awareness of the person/people responsible for stain removal	Occupational disease / explosion and death	All employees	Occupational Health and Safety Law	3	1	40	120	Significant Risk	The person or people who will be working on stain removal must be trained.	Employer	Continuous	0,5	1	40	20	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
51	STAIN REMOVAL PROCESS	Failure to provide personal protective equipment to the standards specified in the material safety data sheet of the specific chemical substance to be used to prevent exposure to thechemical.	Occupational disease	All employees	Occupational Health and Safety Law	3	2	15	90	Significant Risk	Personal protective equipment that meets the standards specified in the material safety data sheet should be selected and its use by employees should be monitored.	Employer	Continuous	0,5	2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
52	STAIN REMOVAL PROCESS	Failure of the employee to use personal protective equipment such as a breathing mask, glasses and gloves during the stain removalprocess.	Occupational disease	All employees	Occupational Health and Safety Law	3	2	15	90	Significant Risk	Personal protective equipment must be used during the stain removal process; work must not be carried out without it.	Employer	Continuous	0,5	2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.

53	STAIN REMOVAL PROCESS	Inadequate ventilation (aspiration system) conditions during the stain removal process	Occupational disease, fire, explosion, death	All employees	Occupational Health and Safety Law	3	1	40	120	Significant Risk	A room must be set up for the stain removal process. This room must be ventilated using appropriate aspiration.	Employer	Continuous	0,5	1	40	20	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
54	STAIN REMOVAL PROCESS	The aspiration ventilation final exit system of the stain removal room is given to the other working area.	Occupational disease, fire, explosion, death	All employees	Occupational Health and Safety Law	3	1	40	120	Significant Risk	It is essential that the exhaust air from the aspiration ventilation system in the stain removal room is discharged outside.	Employer	Continuous	0,5	1	40	20	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
55	STRAIGHT STITCH MACHINE	Improper use of the machine	Needle stick, needle remaining in the skin	All employees	Occupational Health and Safety Law	3	2	15	90	Significant Risk	*When threading the machine needle, make sure that the machine is turned off. *Do not keep your foot on the pedal when changing the bobbin and shuttle. *Keep your hands away from the machine needle while sewing.	Employer	Continuous	0,5	2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
56	STRAIGHT STITCH MACHINE	Finger guards are not available, they must be disabled or the guard must be adjusted to a higher level.	Needle stick, needle remaining in the skin	All employees	Occupational Health and Safety Law	3	2	15	90	Significant Risk	Finger guards must be attached to the machine. While attached, the finger guards must be close to the needle.	Employer	Continuous	0,5	2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
57	STRAIGHT STITCH MACHINE	While working, hair should be long and messy, not tied, loose clothing should be worn, and a scarf with a hanging end should be used.	Occupational accident / near miss	All employees	Occupational Health and Safety Law	3	2	15	90	Significant Risk	Female employees must tie their hair back. They should be reminded to wear loose-fitting clothing and to ensure that the ends of their headscarves are not too long.	Employer	Continuous	0,5	2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
58	STRAIGHT STITCH MACHINE	The machine must be turned on when threading and changing the bobbin.	Limb loss, injury	All employees	Occupational Health and Safety Law	3	2	15	90	Significant Risk	When threading the needle or changing the bobbin, make sure that the machine is turned off.	Employer	Continuous	0,5	2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
59	STRAIGHT STITCH MACHINE	Keeping fingers close to the machine needle or blade while sewing	Limb loss, injury, superficial injury, cut	All employees	Occupational Health and Safety Law	3	2	15	90	Significant Risk	Machine operators should be warned and trained to keep their fingers away from the sewing machine needle and blade during operation.	Employer	Continuous	0,5	2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.

60	STRAIGHT STITCH MACHINE	The thread scissors used are not connected	Fall, puncture, injury	All employees	Occupational Health and Safety Law	3	2	15	90	Significant Risk	Scissors should be properly secured to the machine with a cord.	Employer	Continuous	0,5	2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
61	STRAIGHT STITCH MACHINE	Maintenance or repair of the flat machine during operation	Injury, limb loss, electric shock	All employees	Occupational Health and Safety Law	3	2	15	90	Significant Risk	The power supply, also known as the energy source, of the flat machine to be repaired or maintained must be shut off. Other employees should be informed that maintenance is in progress.	Employer	Continuous	0,5	2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
62	STRAIGHT STITCH MACHINE	During the sewing process, do not engage in other activities, such as talking, using a mobile phone, etc.	Limb entrapment / cut injury	All employees	Occupational Health and Safety Law	3	3	7	63	Possible Risk	While working, no tasks other than the main job should be undertaken, and distractions should be avoided during the work process.	Employer	Continuous	0,5	3	7	10,5	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
63	STRAIGHT STITCH MACHINE	Not cutting off/shutting down the power of the machine when not in use	Occupational accident / fire	All employees	Occupational Health and Safety Law	3	2	15	90	Significant Risk	When machines are not in use, their power supply must be cut off/turned off. Employees should be warned about this.	Employer	Continuous	0,5	2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
64	STRAIGHT STITCH MACHINE	The operator who will use the machine does not have any knowledge about the machine.	Limb loss, injury	All employees	Occupational Health and Safety Law	3	2	15	90	Significant Risk	The operator who will use the machine must be trained in the machine's operating principles and potential hazards.	Employer	Continuous	0,5	2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
65	STRAIGHT STITCH MACHINE	The needles of the machine are broken and the needle tip is not facing the right direction.	Needle ricochet, injury	All employees	Occupational Health and Safety Law	3	2	15	90	Significant Risk	Employees should be provided with PPE appropriate for the chemicals they use, and its proper use should be monitored.	Employer	Continuous	0,5	2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
66	OVERLOCK MACHINE	While working, hair should be long and messy, not tied, loose clothing should be worn, and a scarf with a hanging end should be used.	Occupational accident / near miss	All employees	Occupational Health and Safety Law	3	2	15	90	Significant Risk	Female employees must tie up their hair. They should be reminded not to work in loose clothing and to ensure that scarf ends are not long.	Employer	Continuous	0,5	2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.

67	OVERLOCK MACHINE	Improper use of the machine	Limb entrapment / cut injury	All employees / visitors	Occupational Health and Safety Law	3	3	15	135	Significant Risk	No sudden interventions should be made to the machine during operation. The employee should be trained in the machine they are using.	Employer	Continuous	0,5	2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
68	OVERLOCK MACHINE	Improper use of the machine	Needle stick, needle remaining in the skin	All employees	Occupational Health and Safety Law	3	2	15	90	Significant Risk	When threading the sewing machine needle, make sure that the machine is turned off.Do not keep your foot on the pedal while changing the bobbin and shuttle.Keep your hands away from sewingmachine needle during operation.	Employer	Continuous	0,5	2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
69	OVERLOCK MACHINE	The machine must be turned on when threading and changing the bobbin.	Limb loss, injury	All employees	Occupational Health and Safety Law	3	2	15	90	Significant Risk	When threading the needle or changing the bobbin, make sure that the machine is turned off.	Employer	Continuous	0,5	2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
70	OVERLOCK MACHINE	Finger guards are not available, they must be disabled or the guard must be adjusted to a higher level.	Needle stick, needle remaining in the skin	All employees	Occupational Health and Safety Law	3	2	15	90	Significant Risk	Finger guards must be installed on the machine. While in place, the finger guards should be positioned close to the needle.	Employer	Continuous	0,5	2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
71	OVERLOCK MACHINE	The thread scissors used are not connected	Fall, puncture, injury	All employees	Occupational Health and Safety Law	3	2	15	90	Significant Risk	Scissors should be securely tied to the machine with a cord in a proper manner.	Employer	Continuous	0,5	2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
72	OVERLOCK MACHINE	The scissors threads used are long	Fall, puncture, injury	All employees	Occupational Health and Safety Law	3	2	7	42	Possible Risk	Scissors should be attached in a way that they do not touch the machine or the floor and do not extend above knee level.	Employer	Continuous	0,5	2	7	7	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
73	OVERLOCK MACHINE	Overlock machine operating at high speed	Needle ricochet, injury	All employees	Occupational Health and Safety Law	3	2	7	42	Possible Risk	The sewing machine needle should be inspected periodically, considering the machine's operating speed.	Employer	Continuous	0,5	2	7	7	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.

74	OVERLOCK MACHINE	When changing the needle on the machine, turning off the machine from the threads	Needle burst, needle ricochet injury	All employees	Occupational Health and Safety Law	3	2	15	90	Significant Risk	During these procedures, the machine's power supply must be shut off.	Employer	Continuous	0,5	2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
75	OVERLOCK MACHINE	Putting the wrong oil into the machine	Needle burst, needle ricochet injury	All employees	Occupational Health and Safety Law	3	2	15	90	Significant Risk	Machine oil that meets the specified standards should be used, and the machine should be lubricated at regular intervals.	Employer	Continuous	0,5	2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
76	SNAP BUTTON MACHINE	Keeping your hands under the snaps while using the snap machine	Crushing of fingertips, finger injuries	All employees	Occupational Health and Safety Law	3	2	15	90	Significant Risk	Employees should be reminded to keep their hands away from the machine's point of operation while using the snap machine.	Employer	Continuous	0,5	2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
77	SNAP BUTTON MACHINE	Lack of hand sensor on the sewing machine	Crushing of fingertips, finger injuries	All employees	Occupational Health and Safety Law	3	2	15	90	Significant Risk	A finger detection sensor must be provided and kept in active working condition.	Employer	Continuous	0,5	2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
78	SNAP BUTTON MACHINE	Pressing the foot pedal while placing the upper and lower parts	Crushing of fingertips, finger injuries	All employees	Occupational Health and Safety Law	3	2	15	90	Significant Risk	Snap machine operators should be reminded to remove their feet from the pedals when placing the upper and lower snaps. Employees should be warned and informed about maintaining proper hand–eye–footcoordination in this process.	Employer	Continuous	0,5	2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
79	SNAP BUTTON MACHINE	Among the causes of work accidents; human-induced absent-mindedness	Injury	All employees	Occupational Health and Safety Law	3	3	7	63	Possible Risk	To help prevent employees from becoming distracted, they should take periodic eye rest breaks.	Employer	Continuous	0,5	3	7	10,5	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
80	SNAP BUTTON MACHINE	The operator who will use the machine does not have any knowledge about the machine.	Injury, limb loss	All employees	Occupational Health and Safety Law	3	2	15	90	Significant Risk	The operator who will use the machine must be trained in the machine's operating principles and potential hazards.	Employer	Continuous	0,5	2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.

81	SNAP BUTTON MACHINE	Maintenance or repair of the notching machine during operation	Injury, limb loss, electric shock	All employees	Occupational Health and Safety Law	3	2	15	90	Significant Risk	The power supply, also known as the energy source, of the machine to be repaired or maintained must be shut off. Other employees should be informed that maintenance is being carried out.	Employer	Continuous	0,5	2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
82	USE OF STEAM IRON	Improper use of steam irons	Occupational accident	All employees	Occupational Health and Safety Law	3	2	15	90	Significant Risk	* Care should be taken to ensure that the hoses connecting the boiler to the cleaning tank are in good condition. Worn or torn hoses must be replaced immediately.All connections of the boiler cleaning tank must be tightly secured. The water tightness of the cleaning tank, which is generally made of plastic, should be ensured. Due to heat from steam, breakage, cracking, or bursting may occur.Boiler cleaning should be carried out step by step, and the valves should not be opened fully at once. The cleaning tank should always contain about 5 cm of cold water.The cleaning water should only be drained after it has cooled down. The cleaning tank should have air vents to release excess pressure. Hands should be keptaway from this area.	Employer	Continuous	0,5	2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
83	USE OF STEAM IRON	Formation of high steam pressure during cleaning of steam boilers	Explosion, occurrence of burns	All employees	Occupational Health and Safety Law	3	2	15	90	Significant Risk	Employees should be informed about the dangers of steam pressure, and caution must be exercised during cleaning.	Employer	Continuous	0,5	2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
84	USE OF STEAM IRON	The hoses connected to the boiler's cleaning container are not intact and old and torn hoses are used.	occurrence of burns	All employees	Occupational Health and Safety Law	3	3	7	63	Possible Risk	Care should be taken to ensure that the hoses connecting the boiler to the cleaning tank are in good condition. Worn or torn hoses must be replaced immediately.	Employer	Continuous	0,5	3	7	10,5	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
85	USE OF STEAM IRON	Lack of periodic checks on the leaks of steam iron boilers	Explosion, occurrence of burns	All employees	Occupational Health and Safety Law	3	2	15	90	Significant Risk	Annual periodic inspections of steam boilers must be carried out regularly. Their sealing conditions should be checked, and if any leakage is detected, work must be stopped immediately, and the boiler must be replaced.	Employer	Continuous	0,5	2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.

106	PRESENCE OF SPECIAL RISK GROUPS IN THE WORKING ENVIRONMENT	Presence of pregnant and breastfeeding women	Stress, occupational accident, injuries	Pregnant employee	Occupational Health and Safety Law	3							Possible Risk	Pregnant and breastfeeding employees may not be employed for more than seven and a half hours a day.	Employer	Continuous	0,5		2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
107	PRESENCE OF SPECIAL RISK GROUPS IN THE WORKING ENVIRONMENT	Failure to provide thermal comfort conditions	Distraction, fatigue, miscarriage, occurrence of bleeding	Pregnant employee	Occupational Health and Safety Law	3	2	15	90				Significant Risk	The working areas of pregnant employees must comply with thermal comfort conditions. Work areas should not be excessively cold or hot. For sedentary work, the temperature should not be below 20°C; for standing work, not below 17°C; and for very heavy work, not below 15°C. Airflow speed should not exceed 0.3–0.5 m/s, and relative humidity should be between 30% and 80%.	Employer	Continuous	0,5		1	15	7,5	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
108	PRESENCE OF SPECIAL RISK GROUPS IN THE WORKING ENVIRONMENT	Not under medical supervision	Distraction, fatigue, risk of miscarriage, occurrence of bleeding	Pregnant employee	Occupational Health and Safety Law	3	2	7	42				Possible Risk	Pregnant employees should work under the supervision of a physician and must work in accordance with the duration and manner deemed appropriate by the physician.	Employer	Continuous	0,5		2	7	7	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
109	PRESENCE OF SPECIAL RISK GROUPS IN THE WORKING ENVIRONMENT	Finding an elderly employee	Workplace incidents involving falls or collisions with equipment resulting from balance loss, fainting spells, blackout episodes, or seizures	Elderly employee	Occupational Health and Safety Law	3	2	15	90				Significant Risk	Employees whose mobility is found to be severely impaired according to the workplace physician's report should not be employed in work areas where dangerous machines are present.	Employer	Continuous	0,5		2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
110	PRESENCE OF SPECIAL RISK GROUPS IN THE WORKING ENVIRONMENT	Finding an elderly employee	Injury risk from failing to lift or accidentally dropping loads as a consequence of diminished muscle strength and limited joint mobility	All employees	Occupational Health and Safety Law	3	2	15	90				Significant Risk	Employees should not be allowed to work in the same positions for prolonged periods. They should take breaks to rest and change their body positions.	Employer	Continuous	0,5		2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
111	WORKING ENVIRONMENT	Infectious diseases (Hepatitis B)	High fever, fatigue, and diffuse body aches	All employees	Occupational Health and Safety Law	1	3	40	120				Significant Risk	Vaccination records will be regularly monitored by the workplace physician.	Employer	Continuous	0,5		3	40	60	Possible Risk	This risk value will not be reduced further, and controls will continue to be maintained.

112	ÇALIŞMA OWORKING ENVIRONMENTRTAMI	Infectious diseases (Flu, cough)	Lethargy, elevated temperature, and reduced productivity	All employees	Occupational Health and Safety Law	3	3	7	63	Possible Risk	Employees with contagious illnesses, such as the common cold, should be provided with a mask.	Employer	Continuous	0,5	3	7	10,5	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
113	PRESENCE OF SPECIAL RISK GROUPS IN THE WORKING ENVIRONMENT	Young workers not getting enough rest	Occupational accident resulting in injury	young employee	Occupational Health and Safety Law	3	2	7	42	Possible Risk	The weekly rest period for children and young workers must not be less than forty consecutive hours.	Employer	Continuous	0,5	2	7	7	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
114	PRESENCE OF SPECIAL RISK GROUPS IN THE WORKING ENVIRONMENT	Inadequate rest breaks for young employees	Tiredness	young employee	Occupational Health and Safety Law	3	2	7	42	Possible Risk	For work lasting more than two hours but less than four hours, a 30-minute break must be given; for work lasting from four hours up to seven and a half hours, a one-hour break must be provided in the middle of the workingperiod.	Employer	Continuous	0,5	2	7	7	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
115	PRESENCE OF SPECIAL RISK GROUPS IN THE WORKING ENVIRONMENT	Lack of awareness of young employees' working hours	Overwork and tiredness	young employee	Occupational Health and Safety Law	3	2	7	42	Possible Risk	Children who have completed the age of 15 may be employed for up to 8 hours a day.	Employer	Continuous	0,5	2	7	7	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
116	SHUTTLE VEHICLES	Failure to comply with the maximum legal speed limits of service vehicles	Accident involving the service vehicle resulting in injury and fatality	All employees	Occupational Health and Safety Law	3	1	40	120	Significant Risk	Vehicle drivers must comply with the legal speed limits, and in this regard, some training signs will be requested by the company providing the transportation service.	Employer	Continuous	0,5	1	40	20	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.

117	SHUTTLE VEHICLES	Inadequate knowledge and inexperience of the driver	Road traffic collisions, deaths, and severe injuries	All employees	Occupational Health and Safety Law	3	1	40	120	Significant Risk	Drivers must possess the **"SRC 2 – Domestic Passenger Transportation Professional Competence Certificate"** and the**"Psychotechnical Evaluation Certificate"**. Drivers must meet the qualifications required for the service they are responsible and authorized for. They must not have been convicted, even if pardoned, of crimes specified in Articles 103, 104, 109, 188, 190, 191, and 227 of the Turkish Penal Code, and Article 35 of the Misdemeanor Law No. 5326. They must have held an **E Class Driver's License** for at least 3 years or a **B Class Driver's License** for at least 5 years. Their **criminal record must be clean**. They must not have been involved, as the primary at-fault party or through willful negligence, in fatal traffic accidents, and their driver's license must not have been revoked more than once due to driving under the influence of alcohol or for violating speed limits.	Employer	Continuous	0,5	1	40	20	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
118	SHUTTLE VEHICLES	Exceeding passenger capacity	Road traffic collisions, deaths, and severe injuries	Staff member	Occupational Health and Safety Law	3	1	40	120	Significant Risk	The number of passengers carried in service vehicles must not exceed the number specified in the motor vehicle registration certificate.	Employer	Continuous	0,5	1	40	20	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
119	SHUTTLE VEHICLES	Hot/cold weather	Breathing difficulties and uncomfortable conditions	Staff member	Occupational Health and Safety Law	3	2	7	42	Possible Risk	* The service vehicle must have an air conditioning system.* Fresh air circulation inside the vehicle must be ensured.	Employer	Continuous	0,5	2	7	7	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
120	SHUTTLE VEHICLES	Failure to perform periodic vehicle checks	Accident and death	Staff member	Occupational Health and Safety Law	3	1	40	120	Significant Risk	The vehicle should undergo periodic inspections, and the records should be kept.	Employer	Continuous	0,5	1	40	20	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.

121	DELIVERY	Slipping and falling due to loss of footing during loading	Minor harm, harm	Staff member	Occupational Health and Safety Law	3	2	7	42	Possible Risk	During loading, personnel should use a ladder when attaching straps or receive assistance from another staff member.	Employer	Continuous	0,5	2	7	7	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
122	DELIVERY	Loading in a dark environment	Crushing incidents and resultant harm	Staff member	Occupational Health and Safety Law	3	2	7	42	Possible Risk	When loading is to be carried out in a dark environment, the area must be sufficiently illuminated.	Employer	Continuous	0,5	2	7	7	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
123	DELIVERY	Absence of reverse alarm systems on the vehicles involved in loading operations	Light hand burns and skin irritation	Staff member	Occupational Health and Safety Law	3	2	7	42	Possible Risk	Vehicles arriving for loading must have a functioning reverse gear warning system.	Employer	Continuous	0,5	2	7	7	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
124	WORKPLACE	Incidents of physical aggression or altercations between workers	Injuries and legal proceedings	Staff member	Occupational Health and Safety Law	3	2	7	42	Possible Risk	Communication among employees should be improved.	Employer	Continuous	0,5	2	7	7	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
125	PERSONNEL FILE	Employer's non-compliance in maintaining individual personnel files for all employees	Imposition of administrative penalties and lack of access to employees' records when required	Staff member	Occupational Health and Safety Law	3	3	3	27	Possible Risk	The employer shall prepare a personnel file for each employee. In this file, the employer must keep the employee's identification information along with all documents and records that they are required to prepare under this Law and other laws, and must present them to the authorized officers andauthorities upon request.	Employer	Continuous	0,5	3	3	4,5	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
126	ANNUAL LEAVE	Employees not being allowed to take their entitled annual leave	Exhaustion, distractibility, and decreased efficiency	Staff member	Occupational Health and Safety Law	3	2	15	90	Significant Risk	Employees must take the statutory leave granted to them in accordance with the Labor Law.	Employer	Continuous	0,5	2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.

127	EMPLOYEE INSURANCE	Employees not being registered for social security/insurance	Employees and their families not receiving necessary medical care	Staff member	Occupational Health and Safety Law	3			42	Possible Risk	Employees must not start work without being registered for social insurance. **Social Insurance Law**	Employer	Continuous	0,5	2	7	7	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
128	SICK LEAVE DURATION	Ensuring that employees are granted sufficient rest breaks	Lack of attention leading to reduced productivity	Staff member	Occupational Health and Safety Law	3	2	7	42	Possible Risk	According to Labor Law No. 4857, employees must be given a rest break of 15 minutes for work periods of less than 4 hours, 30 minutes for work periods between 4 and 7.5 hours, and 1 hour for work periods exceeding 7.5hours.	Employer	Continuous	0,5	2	7	7	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
129	FABRIC DUST	Respiratory exposure to fabric particles in the environment	Work-related illnesses and a range of respiratory ailments	Staff member	Occupational Health and Safety Law	3	2	15	90	Significant Risk	An adequate aspiration system should be established in accordance with working conditions, considering the elements specified in the legislation.Employees should be provided with dust masks as a precaution against fabric dust generated during cutting or other fabric processing operations.Employees with fabric dust allergies should be assigned to different departments whenever possible; if it is mandatory for them to work in dusty areas, they must be required to wear a dust mask.Employees should be informed about thehazards of occupational diseases.	Employer	Continuous	0,5	2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
130	EMERGENCIES	Absence of OHS signs	During emergencies, evacuation and intervention are hindered, and workers cannot be alerted or educated on preventing workplace accidents and occupationalillnesses.	Staff member	Occupational Health and Safety Law	3	3	7	63	Possible Risk	Health, safety, warning, information, emergency exit, and first aid signs prepared in accordance with legal provisions must be placed in adequate numbers and in visible locations within the workplace environment.	Employer	One Month	0,5	3	7	10,5	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
131	CLEANING CHEMICALS	Chemicals used in dishwashing, surface disinfection, and general cleaning operations	Can lead to allergic reactions, irritation, and dermatological conditions	Staff member	Occupational Health and Safety Law	3	3	7	63	Possible Risk	Employees responsible for dishwashing and general cleaning should be trained in the occupational disease risks they may face and the hazards of the chemicals they use. They should also be informed about how to protectthemselves from these hazards.	Employer	Continuous	0,5	3	7	10,5	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.

132	WORKPLACE	Potential toxins arising from food contamination due to pest contact	Toxic exposure	Staff member	Occupational Health and Safety Law	3	3	7	63	Possible Risk	The most common characteristic of pests is their rapid reproduction. To eliminate the damage caused by these adaptable creatures, effective pest control measures should be implemented. It is advisable to receive periodic services from a professional pest control company. The use of state-of-the-art electronic pest repellent systems may also bebeneficial.	Employer	Continuous	0,5	3	7	10,5	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
133	WORKPLACE	Absence of gas detectors in critical zones	Blast and fire	All employees / visitors	Occupational Health and Safety Law	3	2	15	90	Significant Risk	Gas leak detectors should be installed in the boiler room and kitchen area. Their functionality should be checked at regular intervals.	Employer	Continuous	0,5	2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
134	WORKPLACE	Employee commencing work without prior training provided by the occupational safety expert and the employer	Occupational accidents and a range of work-related illnesses, injuries, and fatalities	All employees / visitors	Occupational Health and Safety Law	3	2	15	90	Significant Risk	Within the scope specified by the regulation, employees must receive training from the occupational safety specialist and workplace physician according to the annualtraining plan. For employees in the low-risk category, the required training duration is a total of 8 hours, consisting of 6 hours from the specialist and 2hours from the physician.The employer shall provide the necessary venue for the training.No employee should be allowed to start work without receiving Basic Occupational Safety Training from the occupational safetyspecialist and workplace physician.	Employer	Continuous	0,5	2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
135	WORKPLACE	Lack of knowledge regarding exceedance of established noise exposure limits	Impaired hearing	All employees / visitors	Occupational Health and Safety Law	3	2	15	90	Significant Risk	Environmental measures should be conducted to determine the level of noise exposure. Measures should be planned according to the noise level. If necessary, earmuffs or earplugs should be provided to employees and assigned to them throughproper documentation.	Employer	Continuous	0,5	2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.

136	LIGHTNING STRIKE	Lack of grounding installation against lightning strikes and electrical faults	Musculoskeletal system disorders and psychosocial hazards	All employees / visitors	Occupational Health and Safety Law	3	1	15	45	Possible Risk	To protect buildings against the danger of lightning, the requirements of the relevant regulations and standards must be met. Adequate connections must be provided to ensure that the electrical charge can be conducted to the ground without creating a risk to the structure or any other installation within it, and grounding termination must be provided.network must be established.	Employer	Continuous	0,5	1	15	7,5	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
137	WORKPLACE	Utilization of ergonomically inappropriate work tools/equipment	Musculoskeletal system disorders and psychosocial hazards	All employees	Occupational Health and Safety Law	3	2	15	90	Significant Risk	In implementing health and safety requirements, the employer must fully consider employees' postures, working methods during the use of work equipment, and ergonomic principles.	Employer	Continuous	0,5	2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
138	EXITS	Emergency escape and exit routes not being properly marked, obstructed, or lacking direct access	Failure to ensure safe evacuation of occupants in the event of a fire	All employees	Occupational Health and Safety Law	3	2	15	90	Significant Risk	All exits and access routes must comply with the following requirements:Exits and access routes must be clearly visible or highlighted with symbols indicatingtheir location and must be kept free of obstacles at all times to ensure they can be used whenever needed.In a building or its floors, each occupant must have direct access to an exit or exits without having to pass through rooms orspaces used by other occupants.	Employer	Continuous	0,5	2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
139	CANTEEN / DINING HALL	Absence of a properly equipped dining facility that ensures sufficient space, appropriate thermal comfort, hygiene conditions, and adequate furnishings for employees who are required to eat at the workplace	Unsuitable eating area conditions and their impact on human health	All employees	Occupational Health and Safety Law	3	3	7	63	Possible Risk	For employees who must eat their meals at the workplace, a dining area of adequate size and comfort shall be provided, equipped with sufficient equipment and utensils, and meeting appropriate thermal comfort and hygiene conditions. If no more suitable location is available in the workplace, rest areas may be used as dining areas, provided that the necessary conditions are met. The employer may also provide the opportunity for employees to eat outside the workplace, provided that the specified conditions arefulfilled.	Employer	Continuous	0,5	3	7	10,5	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.

140	USE OF WATER DISPENSER	Drinking water	Communicable diseases	All employees	Occupational Health and Safety Law	3	2	7	42	Possible Risk	1. Biological and bacterial tests of mains water and water dispensers should be conducted every 3 months and kept on record in theworkplace.	Employer	Continuous	0,5	2	7	7	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
141	CANTEEN / DINING HALL	Lack of meal inspection through retained samples and deterioration/spoilage of food and beverages	Toxic exposure, epidemic illnesses, and mortality	All employees	Occupational Health and Safety Law	3	3	7	63	Possible Risk	Food samples should be stored in appropriate containers at the proper temperature for 48 hours. The date on which the meals were prepared should be written on the containers. In the event of a possible mass food poisoning incident, these samples, along with carrier (portör) examination records, should bereviewed.	Employer	Continuous	0,5	3	7	10,5	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
142	WINDOWS	Improper window layout and design posing health and safety risks	Lacerations and injuries caused by impacts	All employees	Occupational Health and Safety Law	3	2	7	42	Possible Risk	In workplaces, windows and skylights shall be designed to open, close, and adjust safely. When open, they shall be positioned so as not to pose any danger to employees.	Employer	Continuous	0,5	2	7	7	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
143	AIR POLLUTION	Lack of a smoking ban in confined or indoor workspaces	May lead to respiratory illnesses and stress	All employees	Occupational Health and Safety Law	3	3	7	63	Possible Risk	Smoking should be prohibited in enclosed areas, and the relevant warning sign should be posted in a visible location within the workplace.	Employer	Continuous	0,5	3	7	10,5	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
144	WORKPLACE	Lack of order in the workplace	Physical hazards (trip and fall incidents, objects falling), biological hazards (inadequate hygiene conditions), psychosocial hazards (lack of a comfortable, organized workspace preventing employees from performing their dutiescomfortably)	All employees	Occupational Health and Safety Law	3	3	7	63	Possible Risk	The workplace should be organized in a way that does not create health and safety risks and allows employees to perform their work comfortably.	Employer	Continuous	0,5	3	7	10,5	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.

145	CANTEEN / DINING HALL	Absence of necessary training and hygiene certification for catering staff	Diseases and foodborne poisoning	All employees	Occupational Health and Safety Law	3	2	7	42	Possible Risk	A service contract should be made with the catering company, and a copy of this contractshould be kept in the workplace. Employees of the catering company must have job-specific vocational training and thenecessary hygiene training.	Employer	Continuous	0,5	2	7	7	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
146	LOCKERS / CHANGING LOCKERS	Absence of individual, secure, and appropriately sized lockers in staff changing rooms for employees to store their clothing during work hours	Contaminated garments creating health and safety hazards for workers	All employees	Occupational Health and Safety Law	3	2	7	42	Possible Risk	In changing rooms, each employee shall be provided with a lockable locker of sufficient size to store their clothes during working hours. In workplaces that are damp, dusty, dirty, or involve hazardous materials and similar tasks, a double-compartment locker or two separate lockers shall be provided to store work clothes and personal clothes separately. In workplaces where a changing room is not required, a suitable place shall be designated for employees to store themclothes.	Employer	Continuous	0,5	2	7	7	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
147	TEA STATION AND CANTEEN	Lack of cleanliness in the tea preparation area, kitchen, cafeteria, and rest areas	Lack of hygiene may cause a range of illnesses and contagious diseases	All employees	Occupational Health and Safety Law	3	2	7	42	Possible Risk	The tea station, sink, cafeteria, and rest area should be inspected and cleaned at regular intervals every day, and the necessary hygiene materials for cleaning should be readily available. Storage areas for cleaning materials should be kept away from food and locked.	Employer	Continuous	0,5	2	7	7	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
148	INADEQUATE TOILETS AND WASHBASINS	Poorly maintained and unhygienic toilet and washroom areas	Biological risks, unpleasant smells, and psychosocial hazards	Staff member	Occupational Health and Safety Law	3	2	7	42	Possible Risk	In locations close to workplaces, rest rooms, changing rooms, showers, and washing areas, a sufficient number of toilets and washbasins shall be provided separately for male and female employees, with adequate ventilation, lighting, thermal comfort, and hygiene conditions. Necessary cleaning supplies must be available in the toilets and washbasins.	Employer	Continuous	0,5	2	7	7	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
149	FLOOR	Unsuitable workplace floor conditions	Injuries due to slip, trip, and fall incidents	Staff member	Occupational Health and Safety Law	3	2	7	42	Possible Risk	In workplaces, floor coverings and surfaces should be solid, dry, and as flat, non-slip, and level as possible. If the floor becomes wet during cleaning, a "Caution: Slippery Floor" warning sign should be posted.	Employer	Continuous	0,5	2	7	7	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.

150	WORKPLACE	Presence of obstacles on walking paths designated for emergency evacuation	Occupational accidents, hindered emergency building evacuation, and stampedes	Staff member	Occupational Health and Safety Law	3	3	7	63	Possible Risk	Walkways must always be kept clear. In emergencies, there should be no objects or equipment obstructing escape routes.	Employer	Continuous	0,5	3	7	10,5	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
151	WORKPLACE	Horseplay	Occupational accidents, injuries, and deaths	Staff member	Occupational Health and Safety Law	3	2	15	90	Significant Risk	Employees should be warned not to engage in horseplay involving physical objects, sharp or pointed tools, whether physically or psychologically. Necessary training should be provided to ensure they understand theseriousness of the work and the workplace.	Employer	Continuous	0,5	2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
152	WORKPLACE	Tasks performed in unsuitable environmental temperatures	Unsuitable workplace temperatures negatively impact workers' physical and mental well- being	Staff member	Occupational Health and Safety Law	3	3	7	63	Possible Risk	The workplace should be maintained at temperature conditions appropriate to the nature of the work performed.	Employer	Continuous	0,5	3	7	10,5	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
153	WORKPLACE	Employees with long hair not keeping it tied back during work	Hazard of entanglement and stumbling	Staff member	Occupational Health and Safety Law	3	2	15	90	Significant Risk	Personnel with long hair should keep their hair secured under an appropriate cap or in a hairnet to prevent the risk of entanglement or snagging in work equipment.	Employer	Continuous	0,5	2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
154	WORKPLACE	Prolonged standing without the use of anti-fatigue (anti- varicose) mats, especially for employees engaged in ironing tasks	Joint ailments, vascular circulation impairments, and musculoskeletal conditions	Staff member	Occupational Health and Safety Law	3	2	15	90	Significant Risk	For personnel who stand for long periods (such as ironing staff), anti-fatigue mats should be placed under their feet. Employees should be informed about using these mats, and their usage should be monitored.	Employer	Continuous	0,5	2	15	15	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
155	TOILET, WASHBASIN, SHOWER, AND REST AREAS	Poor hygiene standards in restroom, shower, and rest facilities	Outbreak diseases, bacterial and parasitic infections, and unpleasant smells	Staff member	Occupational Health and Safety Law	3	3	3	27	Possible Risk	In locations close to workplaces, rest rooms, changing rooms, showers, and washing areas, a sufficient number of toilets and washbasins shall be provided separately for male and female employees, with adequate ventilation, lighting, thermal comfort, and hygiene conditions. Necessary cleaning supplies shall be available in the toilets and washbasins.	Employer	Continuous	0,5	3	3	4,5	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.

156	WORKPLACE	No first aid cabinet available with essential medical supplies	Due to the lack of first aid in emergencies, the injured individual's condition can deteriorate	Staff member	Occupational Health and Safety Law	3	2	7	42	Possible Risk	A first aid cabinet or kit, equipped to allow for emergency interventions in the workplace, should be available, and the materials should be recorded in a schedule with their expiration dates and quantities tracked.	Employer	Continuous	0,5	2	7	7	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
157	WORKPLACE	Stacking of materials	Risk of injury from objects dropped from heights and shifting materials	Staff member	Occupational Health and Safety Law	3	1	15	45	Possible Risk	Materials should not be stacked on shelves, and protective barriers should be installed infront of shelves.If there are no shelves, stacking above 3 meters is not allowed; precautions should be taken to prevent materials from falling, andstacking rules should be followed.Heavy materials should be stacked on lower levels. Materials should not be placed in walking and working areas; walkways, workspaces, and areas between machines should be keptclear.Materials should not be left on top of cabinets.Employees should be trained in loading and unloading. Personal protective equipment(PPE) should be used by employees.No materials should be left in front of doors, emergency exits, or electrical panels."No open flames" signs should be posted, and smoking should be prohibited.Materials should be grouped before stacking.	Employer	Continuous	0,5	1	15	7,5	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
158	WORKPLACE	Improperly stored or stacked materials blocking pathways, stairways, emergency exits, and access to fire safety equipment	During emergencies, panic and delayed evacuation may exacerbate the severity of accidents and injuries	Staff member	Occupational Health and Safety Law	3	3	3	27	Possible Risk	Materials should not be placed or stored in passageways. Stored materials should not block the use of doors.	Employer	Continuous	0,5	3	3	4,5	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
159	WORKPLACE	Lack of a designated breastfeeding room	Negative impact on work efficiency caused by insufficient breastfeeding accommodations for female employees	Staff member	Occupational Health and Safety Law	3	2	7	42	Possible Risk	Regardless of their age or marital status, in workplaces employing 100–150 female employees, the employer is required to establish a breastfeeding room for nursing employees to feed their children, separate from the working areas and located no morethan 250 meters from the workplace.	Employer	Continuous	0,5	2	7	7	Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.

160	WORKPLACE	Improper stacking of materials that block access to walkways, stairways, emergency exits, and fire protection equipment	During emergencies, panic and delayed evacuation can lead to more severe accidents and injuries.	Staff member	Occupational Health and Safety Law	3					27	Possible Risk	Materials should not be placed or stored in passageways. Stored materials should not obstruct the use of doors.	Employer	Continuous	0,5					4,5		Low Risk	This risk value will not be reduced further, and controls will continue to be maintained.
Prepared by	İŞVEREN / VEKİLİ		OCCUPATIONAL SAFETY EXPERT		OCCUPATIONAL HEALTH DOCTOR							EMPLOYEE REPRESENTATIVE		EMPLOYEE REPRESENTATIVE								SUPPORT STAFF MEMBER		
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A Study on The Occupational Safety Perceptions of Employees in Istanbul's Tuzla Shipyards

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Abstract

This study was conducted to assess the current status of occupational health and safety (OHS) practices in the shipbuilding industry among workers employed at shipyards located in the Tuzla district of Istanbul. The study analyzes the effectiveness of OHS practices, awareness levels, and risk perception through a survey administered to 57 shipyard workers engaged in various tasks such as shipbuilding, maintenance-repair, and dismantling. The survey results revealed that although the majority of participants (79%) stated that they had received OHS training, only 47% found their working environment safe. While 64.91% of participants believed that personal protective equipment was used regularly, 40.35% thought that the risk of occupational accidents was high. Furthermore, high levels of uncertainty regarding issues such as the adequacy of emergency plans and the frequency of inspections indicate that employees do not always find OSH practices to be transparent and consistently applicable.

The findings also reveal that subcontracted workers may not fully benefit from OSH services and that long working hours and heavy workloads may negatively affect safe behavior. Differences in risk perception were also observed among workers in different departments, such as ship dismantling, construction, and maintenance and repair.

In conclusion, the study revealed that OSH culture is developing in the shipyard industry, but there are significant shortcomings in ensuring the coordination and sustainability of these practices. Accordingly, it is recommended to increase the content and frequency of training, strengthen control mechanisms, and develop risk-focused preventive strategies.

Keywords: Shipyard, Occupational Health and Safety, Marmara Region, Emergency Plans, OHS Practices, Employee Perception.

INTRODUCTION

Occupational health and safety (OHS) is a discipline that functions both technically and legally to ensure that employees work in a safe and healthy environment. Occupational accidents and occupational diseases are serious problems that threaten the mental and physical integrity of employees. Globally, millions of occupational accidents occur every year and hundreds of thousands of employees suffer from occupational diseases (Enginel & Toptancı, 2017). This situation not only affects the quality of life and safety of individuals, but also leads to disruptions in the production processes of enterprises, decreases in productivity and serious financial losses. Preventing occupational accidents and occupational diseases, ensuring safe working conditions in workplaces and developing awareness and culture in this field are among the main objectives of occupational health and safety.

Accidents occur worldwide and, in every sector, employees are injured, disabled and unfortunately lose their lives. As in other business lines, the shipbuilding sector is a highly dangerous and risky area and the probability of accidents in this sector is quite high. It is theoretically aimed at preventing accidents completely, but it is quite difficult to achieve this goal. Therefore, the main objective is to minimize future accidents by drawing lessons from existing accidents. When all elements in the sector fulfil their duties completely, it will be easier to prevent accidents and deaths. The first step in preventing occupational accidents is a detailed examination of existing accidents. Accurate determination of the causes of accidents forms the basis of the measures to be taken to prevent the recurrence of similar accidents. The approach accepted worldwide is based on this simple principle. Many rules and criteria of the International Maritime Organization (IMO) have been developed following major accidents in line with this main principle. However, the ideal is to identify the possible risks at work in advance and take measures to prevent accidents in advance, rather than taking lessons from accidents that constantly occur (Taylan, 2008).

The shipbuilding industry is one of the heavy industry branches with a high risk of occupational accidents and occupational diseases. Preventing accidents and occupational diseases, protecting employees from hazards and ensuring safe working conditions in this sector is of critical importance both to improve the quality of life of individuals in the sector and to make the development of the sector sustainable. Considering that 90% of occupational accidents in the shipbuilding industry are caused by employee errors, the importance of the human factor is clearly evident. 60% of occupational accidents are directly and 30% are indirectly caused by human error. (Taylan, Occupational Accidents in Shipyards and Occupational Safety, 2008) Therefore, the establishment of an occupational safety culture and continuous and sustainable training of employees play a fundamental role in preventing accidents and occupational diseases. In order to create an effective OHS culture, it is important for everyone in the workplace to make safe behavior a habit, to recognize and control hazards and risks (Tutar, Nam, & Nam, 2019).

The Occupational Health and Safety Law No. 6331 in force in Turkey regulates the duties, authorities, responsibilities, rights and obligations of employers and employees in order to ensure occupational health and safety in workplaces and to improve existing health and safety conditions. Within the framework of this law, employers are required to take all kinds of measures, including prevention of occupational risks, training and information, organization and provision of necessary tools and equipment to ensure the health and safety of employees. Employers are obliged to monitor and inspect whether the occupational health and safety measures taken in the workplace are complied with and to ensure that nonconformities are eliminated. In addition, they must take the necessary precautions by making a risk assessment in the workplace, taking into account the suitability of employees for work in terms of health and safety. Employees are obliged not to jeopardize their own health and safety and the health

and safety of other employees affected by their work.

The impact of occupational accidents and occupational diseases on enterprises is large and multifaceted. For example, the cost of occupational accidents and occupational diseases in Turkey in 2011 was calculated as approximately 7.7 billion TL, and according to the International Labour Organization (ILO) data, the ratio of occupational accidents and occupational diseases to GDP varies between 1% and 3% in developed economies, while this ratio is between 4% and 6% in developing countries. When this ratio is taken into account for Turkey, it is seen that the total cost reaches 44 billion TL. These costs include not only economic but also social dimensions. Injury, disability or death of employees as a result of occupational accidents can lead to large-scale social and economic problems by directly affecting the families of employees. The importance of OHS is critical in terms of protecting the labour force and increasing productivity (Menteşe, İnce, & Özcan, 2017).

In conclusion, occupational health and safety has a great importance in the protection of individual and social welfare, sustainability of enterprises and development of national economies. Effective implementation of OHS practices in high-risk areas such as the shipbuilding industry is a vital requirement for minimising occupational accidents and occupational diseases. This study aims to determine the risks in the shipbuilding industry, to contribute to the awareness of employees, to prevent occupational accidents and to provide safer working conditions.

METHODOLOGY

This study was conducted to evaluate occupational health and safety (OHS) practices in various shipyards operating in the Marmara Region. A Likert-type, closed-ended survey was used as the data collection tool. The survey included questions about workplace emergency plans, management's commitment to OHS, the condition of health and safety equipment, and the reportability of health and safety issues.

The surveys were administered online via the Google Forms platform during January and February 2025. The aim was to ensure participant anonymity and easy accessibility. A total of 57 employees from different shipyards in the Marmara Region participated in the research. The majority of participants were male (89.5%), and most had a university-level education or higher. Additionally, 40.4% of the participants were sub-contracted employees working in various operational departments (e.g., construction, maintenance, dismantling).

The collected data was transferred from Google Forms to an Excel spreadsheet, where it was evaluated using basic frequency and percentage distribution analyses. No advanced statistical methods were used. The findings were interpreted through descriptive analysis. This method was employed to determine how employees perceive OHS practices in Marmara Region shipyards and to identify areas for improvement.

RESULTS

In the study, the demographic status and occupational health and safety perceptions of the employees were determined by questionnaire method. In the questionnaire, basic demographic information such as age, gender, marital status, educational status, working period and working status of the participants were determined. This information helps us to understand the structure of the workforce in the sector, which groups are over-represented and which groups potentially require special training or safety measures.

Determining the Demographic Status of Employees

When the age distribution of the employees in shipyards is analysed, it is seen that the 26- 35 age group (33.3%) constitutes the highest rate, followed by the 18-25 age group (29.8%). This shows that the sector is largely composed of young and middle-aged employees. The 36-45 age group (24.6%) represents the most experienced employees, while the rate drops significantly in the 46-55 age group (12.3%). The fact that there are no employees aged 56 and above indicates that the harsh working conditions in shipyards drive employees away from the sector as they get older. This situation reveals that young employees should be made aware of occupational health and safety, experienced employees should be directed to transfer knowledge and ergonomic arrangements should be increased for older employees.

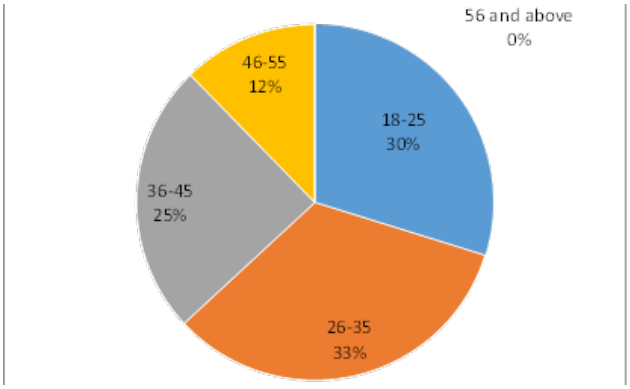

Figure 1. Age Distribution of Participants

The gender-based results of the survey show that men constitute the majority. According to the data, 89.5 per cent of the employees are male and 10.5 per cent are female. This distribution reflects the fact that male employees are more likely to work in areas such as shipyards, which require physical labour and have difficult working conditions.

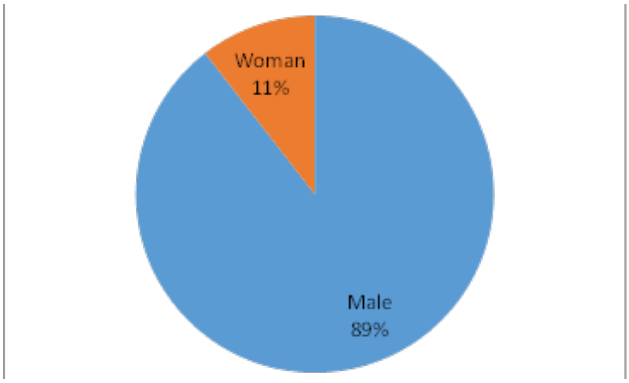

Figure 2. Gender Distribution of Participants

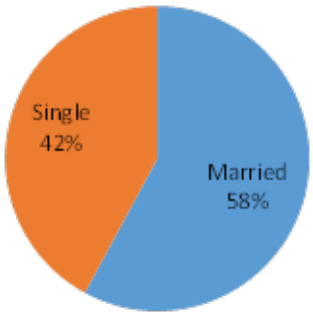

Figure 3. Marital Status Distribution of Participants

According to the marital status of the questionnaire, the results show that most of the employees are married. According to the data, the proportion of married employees is 57.9% and the proportion of single employees is 42.1%. This distribution can help us to understand how the personal life situation of employees in the workplace can affect their occupational health and safety perceptions and needs. The high rate of married employees indicates the existence of a labour force structure with more family responsibilities. Family obligations may cause employees to be more concerned about occupational safety or to approach safety measures more carefully.

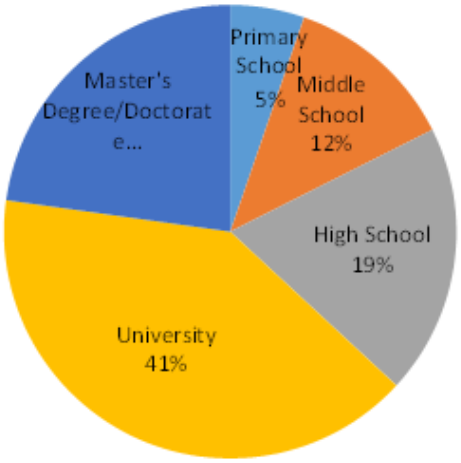

Figure 4. Distribution of Education Level of Participants

According to the data on the educational level of shipyard employees, the largest proportion of the participants are university graduates (40.4%), followed by master's/ doctorate graduates (22.8%). This shows that a significant portion of shipyard employees have a high level of education. High school graduates (19.3%) also constitute a significant group , while secondary school (12.3%) and primary school graduates (5.3%) are represented at lower rates. This distribution shows that the level of education in shipyards is generally high and it can be said that as the level of education increases, the awareness and knowledge of employees on occupational health and safety also increases. However, targeted training programmes and safety measures should be developed for each group.

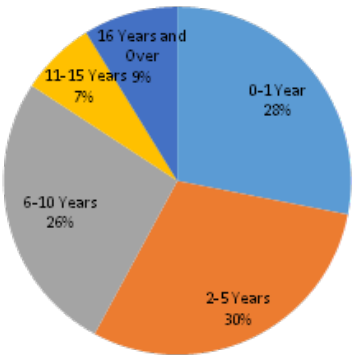

Figure 5. Distribution of Participants' Working Period in Shipyards

According to the duration of employment in the shipyard, it is observed that the largest portion of the employees have 2-5 years of experience (29.8%) and 0-1 year (28.1%). This shows that the sector is generally dominated by a labour force with new or mid-level experience. The proportion of employees with 6-10 years of experience is also quite high (26.3%), but 11-15 years (7%) and 16 years and above (8.8%). It can be said that as the working time in the shipyard increases, employees gain experience and become more conscious about occupational health and safety. However, as the working time increases, safety risks may also increase due to physical fatigue and habits. Therefore, special health monitoring, safety drills and ergonomic arrangements should be made for experienced employees. On the other hand, intensive training programmes and increased inspections for new employees are critical for raising safety awareness at an early age. As a result, separate safety strategies should be developed for employees with different working hours. Training for beginners, continuous supervision and health monitoring for experienced workers, and special ergonomic and safety measures for long-term workers should be prioritised.

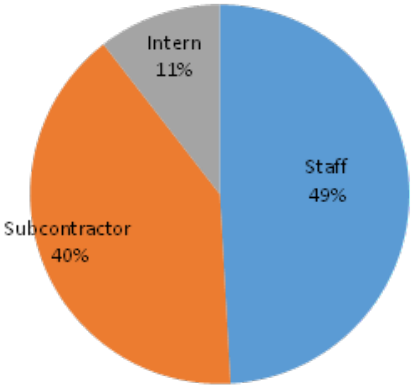

Figure 6. Distribution of Participants by Employment Status

According to the data on employment status, almost half of the respondents (49.1%) are permanent employees, while the proportion of subcontracted workers is quite high (40.4%). This shows that subcontract labour is a common practice in the shipyard sector. The rate of interns is lower with 10.5

per cent. Considering that subcontracted workers may be disadvantaged in accessing occupational health and safety standards compared to permanent workers, it is important to develop special policies to raise awareness and protect this group. While permanent employees constitute the largest group of the workforce and the most integrated into the safety culture, it is important to increase safetymeasures and training for subcontracted and trainee workers. It should not be forgotten that subcontracted employees may have lower safety awareness and interns require extra attention due to their inexperience.

According to income level data, the majority of respondents (70.2%) earn a monthly income of 30,001 TL and above, while other income groups are represented at lower rates. The rate of those with a monthly income between 20,001-30,000 TL is 15.8 per cent, and between 17,001-20,000 TL is 5.3 per cent. This distribution shows that the shipyard sector is dominated by employees with high income levels. This situation can be associated with the high rate of employees with higher education level and the knowledge demanded by the sector.

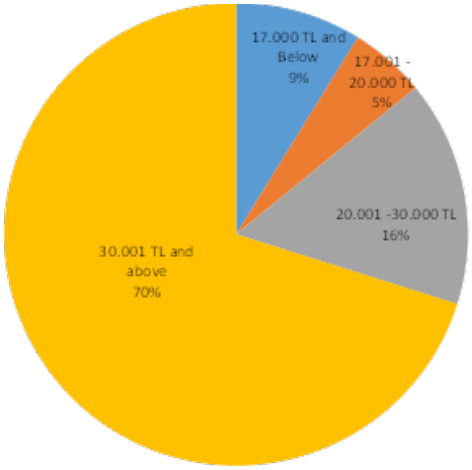

Figure 7. Distribution of Monthly Income Level of the Respondents

According to income level data, the majority of respondents (70.2%) earn a monthly income of 30,001 TL and above, while other income groups are represented at lower rates. The rate of those with a monthly income between 20,001-30,000 TL is 15.8 per cent, and between 17,001-20,000 TL is 5.3 per cent. This distribution shows that the shipyard sector is dominated by employees with high income levels. This can be attributed to the high proportion of employees with higher education levels and the know-how demanded by the sector.

According to the distribution by departments, shipbuilding (29.8 per cent) and ship maintenance and repair (31.6 per cent) departments have the highest rates. This shows that the labour force in shipyards is largely concentrated in these two fields. Ship dismantling and other departments are represented in equal proportions (19.3 per cent). The occupational health and safety needs of workers in each department are different and this makes it necessary to provide specialised training on a departmental basis. For shipbuilding workers, information on high physical safety precautions and working with hazardous materials should be provided. Ship maintenance and repair workers should receive specialised training in electrical safety, working with chemicals and maintenance of machinery. For the ship dismantling department, special attention should be paid to safety, the use of heavy machinery, hazardous materials management and fire safety. Although other departments have lower risks, general occupational health and ergonomics trainings are important.

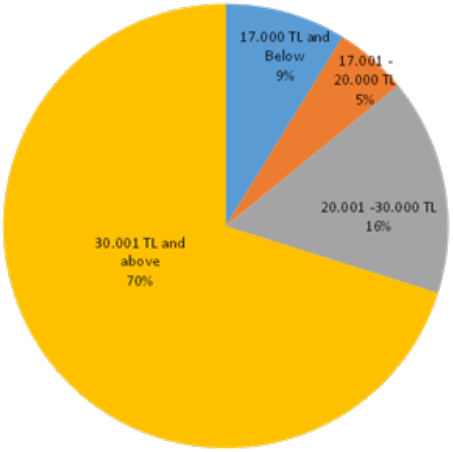

Figure 8. Distribution of the Departments of the Participants

Data on working hours show that the majority of workers (49.1 per cent) work between 41- 50 hours per week, followed by 24.6 per cent working 51 hours or more. This reveals that intensive and long working hours are common in shipyards. The rate of those working between 31-40 hours is lower with 14 per cent, while those working 30 hours or less constitute the lowest group with 12.3 per cent. Long working hours can increase occupational health and safety risks and trigger physical and mental fatigue. Therefore, it is critical to increase workload balancing and rest arrangements, especially for the group working 50 hours or more.

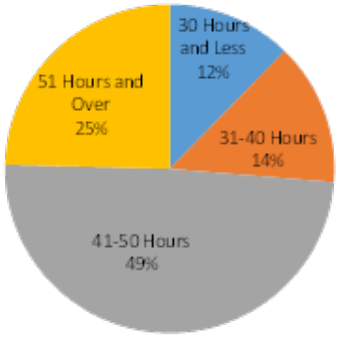

Figure 9. Distribution of Average Working Hours of Participants in the Work Area

Evaluation of Occupational Health and Safety Perceptions of Employees

Employees' occupational health and safety (OHS) perceptions and knowledge form the basis of safety

culture in the workplace. The better employees understand potentialhazards, the more likely they are to avoid risky behaviours and adopt safe working methods. A well-informed employee helps to protect not only themselves but also their colleagues from potential accidents. Unfortunately, in many workplaces, employees' knowledge of OHS may remain superficial or may not be sufficiently reflected in daily practices because it is only at a theoretical level. This may be due to lack of training, complexity of safety procedures, or lack of attention to OHS by managers. Employees' perceptions of OHS are generally shaped by their personal experiences, past accident rates in the workplace and the general attitude among their colleagues. If safety measures are consistently ignored or accidents are frequent in a workplace, employees may perceive OHS as a bureaucratic burden and this may negatively affect compliance with safety standards.

For this purpose, these questions were asked to the participants to determine the perceptions of employees on occupational health and safety. In their answers to the question "My working environment is safe", 38.60% of the participants said "agree" and 8.77% said "strongly agree". These results show that approximately 47% of the employees find their working environment safe. On the other hand, 26.32% were undecided, 17.54% "disagree" and 8.77% "strongly disagree". The total of those who expressed negative opinions is 26.31%. This situation shows that the perception of safety is not equal among all employees and some employees find occupational health and safety practices inadequate. The rate of undecided respondents also indicates that there is a lack of awareness or knowledge on this issue. In general, making OHS practices more transparent and permanent is important in terms of strengthening employees' perception of safety.

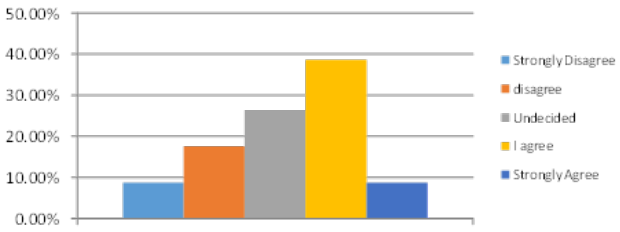

Figure 10. Bar graph representation of the answers of the participants to the question "My working environment is safe

To the question "I received adequate training on occupational health and safety", 68.42% of the participants answered "agree" and 10.53% answered "strongly agree". This indicates a satisfaction rate of approximately 79% in total. This high rate shows that OHS trainings are generally effective in shipyards and the majority of the employees feel adequate in this regard.

On the other hand, 15,79% of the participants answered "undecided" and stated that they could not make a clear judgement about the adequacy of the training. In addition, a small group of 5.26% responded "disagree" and stated that they thought that the trainings were inadequate. The fact that there was no one who said "strongly disagree" shows that the negative perception in this area is quite low.

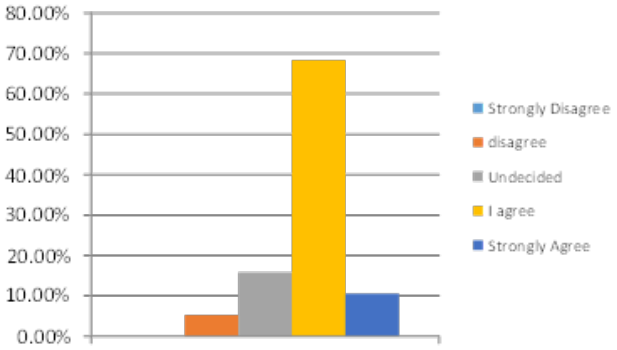

Figure 11. Bar graph representation of the answers of the participants to the question "I received adequate training on occupational health and safety

In general, it is understood that occupational health and safety trainings are provided in a widespread and effective manner, but considering the rate of undecided respondents, it may be useful to re-evaluate the content, practical parts or frequency of the trainings.

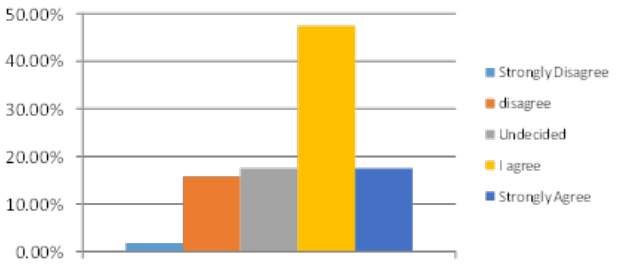

Figure 12. Bar graph representation of the answers of the participants to the question "Personal protective equipment (PPE) is regularly used in my workplace

To the question "Personal protective equipment (PPE) is used regularly in my workplace", 47.37% of the participants "agree" and 17.54% "strongly agree". This shows that there is a positive perception that the use of PPE is regular at a rate of approximately 64.91% in total. This rate indicates that most of the shipyard employees think that there is sufficient organisation in the use of personal protective equipment.

However, the "undecided" answer of 17,54% indicates that there is a significant uncertainty and PPE use may not be regular enough in some cases or in some areas. In addition, 15.79% "disagree" and 1.75% "strongly disagree" indicate a significant negative perception of 17.54% in total. This result suggests that there are implementation or supervision deficiencies in the use of PPE.

In general, although there is a positive awareness on the use of PPE, as the undecided and negative responses together exceed 35%, it would be beneficial to improve and conduct strict inspections on the prevalence and regularity of PPE use. In addition to the trainings, it is important to continuously monitor the use in the field and eliminate the deficiencies.

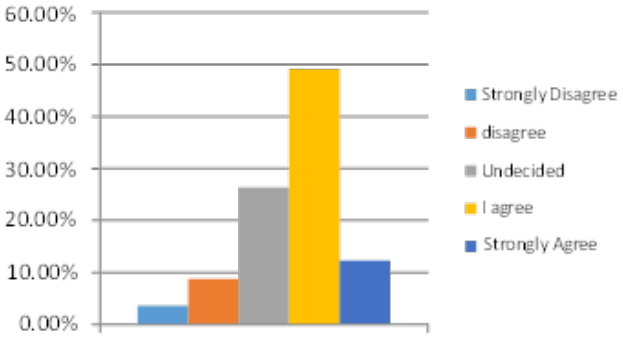

Figure 13. Bar graph representation of the answers of the participants to the question "My colleagues comply with occupational health and safety rules

To the question "My colleagues comply with occupational health and safety rules", 49.12% of the participants answered "agree" and 12.28% answered "strongly agree". This shows that the majority of the employees, approximately 61.4% in total, think that their colleagues comply with OHS rules. This positive opinion indicates that there is a general compliance with OHS rules in shipyards.

However, the "undecided" response with a rate of 26.32% indicates the existence of a significant uncertainty and reveals that approximately one fourth of the employees do not have a clear opinion on this issue. This situation suggests that there may be a lack of consistency in the implementation or follow-up of OHS rules.

On the other hand, the responses of 3.51% "strongly disagree" and 8.77% "disagree" indicate that approximately 12.3% of the employees have a negative perception that their colleagues do not comply with OHS rules. This indicates that there are still some deficiencies and risks in compliance.

In general, although there is a general positive perception about the compliance of colleagues with OHS rules, the fact that the undecided and negative responses exceed 38% in total indicates that the consistency of OHS practices and employee awareness should be increased. In this respect, it is important to strengthen OHS culture and to activate inspection mechanisms.

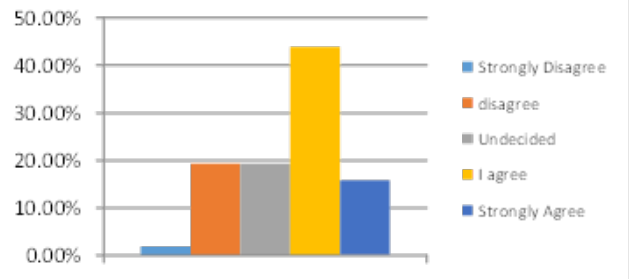

Figure 14. Bar graph representation of the answers of the participants to the question "Occupational health and safety inspections are carried out regularly at my workplace

To the question "Occupational health and safety inspections are carried out regularly in my workplace", 43.86% of the participants answered "agree" and 15.79% answered "strongly agree". In total, approximately 59.65% positive responses indicate that inspections are generally carried out and that a significant portion of employees are aware of this issue.

However, the "undecided" response of 19.30% shows that there is a certain uncertainty among the employees about the frequency and effectiveness of audits. In addition, 19.30% of "disagree" and 1.75% of "strongly disagree" responses indicate that a total of 21% perceive that inspections are not conducted regularly enough.

These data suggest that OHS inspections are generally carried out, but improvements are needed in terms of regularity and effectiveness. The frequency of inspections should be increased and the results should be shared with employees so that OHS culture can be further strengthened.

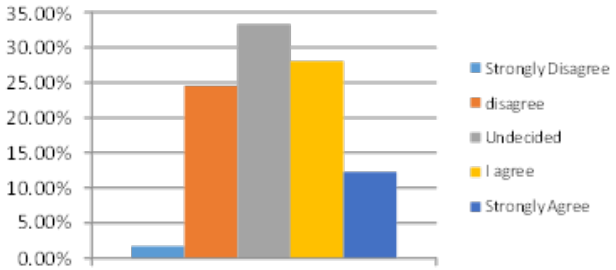

Figure 15. Bar graph representation of the answers of the participants to the question "I am likely to have an occupational accident at my workplace

To the question "I am likely to have an occupational accident at my workplace", 1.75% of the participants answered "strongly disagree" and 24.56% answered "disagree". In total, approximately 26.31% of the employees think that the probability of occupational accidents is low.

On the other hand, 28,07% "agree" and 12,28% "strongly agree" that the risk of occupational accidents at work is high. This shows that approximately 40.35% of the respondents perceive the risk of occupational accidents as high.

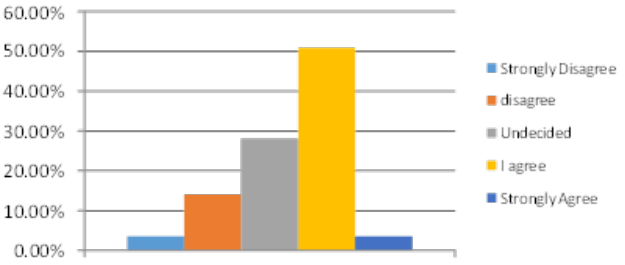

Figure 16. Bar graph representation of the answers of the participants to the question "Emergency plans and procedures are adequate in my workplace

The 33.33% "undecided" response shows that approximately one third of the employees have difficulty in expressing a clear opinion about the risk of occupational accidents.

In general, a significant portion of employees perceive the risk of experiencing an occupational accident at work as high. Considering the rate of undecided respondents, it can be said that the perception of occupational accident risk is serious and preventive measures should be increased to reduce the risks. Effective training and supervision mechanisms need to be increased in order to strengthen the occupational health and safety culture and reduce the risk perception of employees.

To the question "Emergency plans and procedures are sufficient in my workplace", 50,88% of the participants answered "agree" and 3,51% answered "strongly agree". The positive rate of 54.39% in total shows that emergency plans and procedures are considered sufficient by the majority of employees.

On the other hand, the "undecided" response of 28.07% indicates that a significant number of employees do not have a clear opinion on the adequacy of emergency plans and procedures. This may mean that the plans are not sufficiently publicized to the employees, or the implementation practices are not effective.

In addition, 14.04% "disagree" and 3.51% "strongly disagree" rates show that a significant portion of 17.55% in total find emergency plans inadequate.

In general, it can be said that emergency plans and procedures are available and accepted by the majority. However, the fact that the total number of undecided and negative responses is around 45% indicates that information, implementation and updating activities in this field should be increased.

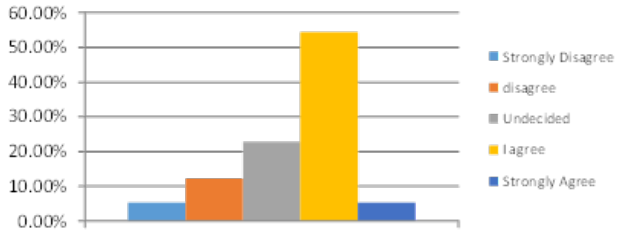

Figure 17. Bar graph representation of the answers of the participants to the question "Top management attaches importance to occupational health and safety

To the question "Top management attaches importance to occupational health and safety", 54.39% of the participants answered "agree" and 5.26% answered "strongly agree". In total, 59.65% of the respondents answered in the affirmative, indicating that the majority of the employees believe that senior management attaches importance to OHS.

However, the 22.81% "undecided" response indicates that a significant portion of the employees do not have a clear opinion on this issue and there is uncertainty about the management's attitude towards OHS. This situation suggests that there may be communication or perception differences between management and employees.

On the other hand, the responses of 5.26% "strongly disagree" and 12.28% "disagree" reveal that a total of 17.54% of the employees perceive that the management does not give enough importance to OHS. This shows that there are situations where management support is not fully felt.

As a general evaluation, although the perception that senior management attaches importance to occupational health and safety is generally positive, the sum of undecided and negative responses approaching 40% indicates that management policies should be better communicated to employees and supportive practices should be increased.

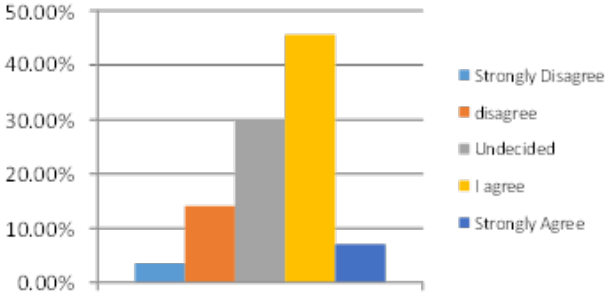

Figure 18. Bar graph representation of the answers of the participants to the question "Health and safety equipment at my workplace is adequate and well maintained

To the question "The health and safety equipment at my workplace is adequate and well maintained", 45.61% of the participants answered "agree" and 7.02% answered "strongly agree". In total, approximately 52.63% of the respondents answered in the affirmative, suggesting that health and safety equipment is largely adequate and well-maintained.

However, the "undecided" response of 29.82% indicates that a significant proportion do not have a clear view on the adequacy and maintenance of the equipment. This indicates that there may be a lack of knowledge or observed variability among employees about the condition of the equipment.

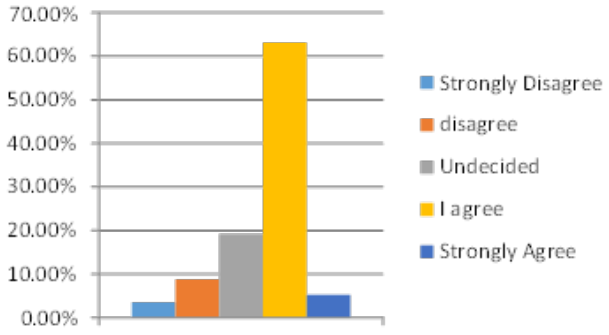

Figure 19. Bar graph representation of the answers of the participants to the question "I can easily report the health and safety problems I encounter in my workplace

In addition, the responses of 14.04% "disagree" and 3.51% "strongly disagree" reveal that a total of approximately 17.55% think that the equipment is inadequate or poorly maintained. In general, although there is a positive opinion about the

condition of health and safety equipment, the fact that the total of undecided and negative responses is approximately 47% shows that improvement and information activities should continue in this area.

To the question "I can easily report the health and safety problems I encounter in my workplace", 63.16% of the participants answered "agree" and 5.26% answered "strongly agree". In total, approximately 68.42% of the employees feel competent and comfortable in reporting health and safety problems.

On the other hand, the "undecided" response of 19.30% indicates that some employees are hesitant about the ease of the reporting process. This may indicate that the reporting mechanism should be made more transparent and accessible. In addition, 8.77% "disagree" and 3.51% "strongly disagree" responses indicate that a total of approximately 12.28% of employees have difficulties in reporting. This situation reveals the need for improvement and support in reporting systems. In general, although the majority of employees feel adequate in reporting health and safety issues, considering the sum of undecided and negative responses, it is important to make reporting processes more user-friendly and to inform employees.

CONCLUSION AND RECOMMENDATIONS

Shipyards are workplaces where shipbuilding, maintenance-repair and dismantling activities are carried out intensively and physical, chemical and ergonomic risks are high. This study aims to evaluate the current status of occupational health and safety practices in shipyards through literature and field research. The literature review showed that shipyard environments harbor various hazards due to their complexity and multidisciplinary nature; accidents are largely caused by human error, equipment deficiencies and managerial inadequacies. The survey confirms that this general observation is in line with the perceptions and experiences of shipyard workers.

According to the data obtained, most of the participants (89.5%) are male and it is seen that the sector has a gender-based labor force distribution. Considering the level of education, the fact that the rate of university (40.4%) and master's/doctorate graduates (22.8%) is quite high supports the high level of awareness of employees towards OHS practices in general. As a matter of fact, approximately 79% of the participants stated that they received adequate training on occupational health and safety. However, there is a lower perception of confidence in the safety of the work environment; only 47 per cent of the respondents consider their work environment safe, while 26.3 per cent have a negative opinion. This situation indicates that even if OHS training is widespread, the deficiencies in implementation are felt by the workers.

It has been determined that subcontracted workers (40.4%) have a significant place in terms of employment status, and it has been evaluated that OHS practices are weaker for this group, and they cannot benefit from inspection processes sufficiently. As a matter of fact, it is frequently emphasized in the literature that subcontracting increases the risk of accidents by leading to audit weakness and organizational deterioration. In addition, it was observed that a significant portion of the employees worked more than 50 hours per week (24.6%), indicating that physical and mental fatigue may negatively affect safe behaviors.

The risk distribution varies according to the departments, and ship dismantling activities involve serious environmental and health threats, especially asbestos and heavy metal exposure. According to the survey results, the risks faced by workers in different departments such as dismantling, maintenance and construction vary, and this situation necessitates the development of specialized training and supervision systems based on departments.

In conclusion, this study on occupational health and safety in shipyards shows that the OHS culture in the sector is being institutionalized, but there are still many areas that need to be improved. In this respect, the following recommendations can be made:

Strengthening Supervision Mechanisms: It is essential to establish independent and regular audit mechanisms in order to ensure equal implementation of OHS practices for all employees, especially subcontracted workers.

Differentiation of Training Content: Developing OHS training courses customized according to education level and working hours will contribute to raising awareness, especially among new workers.

Regulation of Workload and Working Hours: In order to prevent fatigue caused by long working hours, shift systems should be reviewed, and adequate rest periods should be provided to employees.

Department Based Risk Assessments: Separate risk analyses should be conducted for different operational areas such as shipbuilding, maintenance-repair and dismantling, and preventive strategies should be determined accordingly.

Monitoring Occupational Health Indicators: Continuous monitoring and reporting systems should be established on issues such as health screenings, use of PPE, and follow-up of occupational diseases; thus, early warning mechanisms should be activated.

Supporting Female Employees: Although the rate of female employees in the sector is quite low (10.5 per cent), both physical conditions and social prejudices need to be re-evaluated in order for women to be more involved in the sector.

In conclusion, establishing a sustainable occupational health and safety culture in shipyards is of strategic importance not only in terms of regulatory compliance but also in terms of increasing productivity and employee welfare in the sector. The findings of this study aim to contribute to the consideration of OHS practices in the shipyard sector in a scientific framework and to provide data-based policy

development opportunities for decision makers.

REFERENCES

1. Ayvaz, T., & Ergör, O. A. (2023). Analysing Occupational Health and Safety in Shipyards through Indicators. Journal of Engineer and Machinery , 280-288.
2. Boran, M. (2022). Environmental Impacts of Maritime Activities. Ruhun Gemisi Şana Taka Culture and Art Journal , 87.
3. Dizdar, E. N., & Koçar, O. (2018). Assessment of Risks in Occupational Health and Safety Management Systems with Artificial Neural Networks. Academic Platform Journal of Engineering and Science , 73-83.
4. Enginel, N., & Toptancı, Ş. (2017). Modelling of Work Accident Data with Probability Distributions. Journal of Engineering Sciences and Design .
5. Ergün, Ü. R., & Bulut, E. (2024). Responsibility towards Raw Materials: Ship Recycling and Efficiency Assessment in Iron and Steel Industry. Hacettepe University Journal of Faculty of Economics and Administrative Sciences.
6. Güler, A. (2015, October). Chemical Risk Assessment in Ship Maintenance and Repair Sector. Department of Chemical Engineering Master's Thesis. Ankara: Gazi University Institute of Science and Technology.
7. Işık, M. K. (2016). Occupational Health and Safety in Closed Areas of Ship Maintenance and Repair Sector. Ankara: Ministry of Labour and Social Security.
8. Menteşe, G., İnce, E., & Özcan, B. (2017). Investigation of Occupational Health and Safety Awareness in Shipbuilding Industry. Journal of Engineer and Machinery, 56-57.
9. ŞenoL, S., Barlas, B., & Özdemir, Y. H. (2020). Occupational Diseases and Shipyards in Turkey. Journal of Humanities and Tourism Research , 64-66.
10. Tansoy, T. R. (2017). Measures to be Taken in the Prevention of Work Accidents in Shipyards and Risk Analysis. Master Thesis . Kocaeli.
11. Taylan, M. (2008). Work Accidents Occurring in Shipyards and Occupational Safety. Shipbuilding and Marine Technology Technical Congress, (pp. 271-272).
12. Tutar, H., Nam, S., & Nam, D. (2019). Determinants of Safety Culture in Preventing Occupational Accidents: A Research on Shipbuilding Industry. International European Journal of Managerial Research (EUJMR) , 101-102.
13. Ünsan, Y., İnsel, M., & Helvacıoğlu, İ. H. (2007). Turkey Specific Determinations in the Selection of Shipyard and Ship Dismantling Sites. 6th National Coastal Engineering Symposium, (pp. 69-70). Izmir.
14. Viran, A., & Barlas, B. (2018). Studies in Closed Areas on Ships and. Journal of Ship and Marine Technology , 23-24.