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**Albahrani, Ali A. *Effects of Dust on Employees Working in The Oil Wells in The Desert for XZY Oil “Company in Saudi Arab***

**Abstract**

This study examines the effects of dust on employees working in the oil wells in the desert, how they are protected, and what regulation Saudi Arabia has to address this issue. The study will also look for solutions to help XZY Oil Company provide possible solutions to employees working in such environments. This study examined similar case studies, literature and surveyed to achieve the goal. The data were collected to understand the company and the conditions the workers have to work in. The study results reveal that many of the factors related to protective behaviors were missing and overlooked by both the employees and the management. There is a need for safety training, such as the type of PPE and proper use. Also, management should regularly check on the employees to make sure they are following the safety procedures. The study provides significant insights on how workers follow protective behavior while working in dusty conditions and the potential effects of working in such an environment. At the end of the study, suggestions for XZY Oil Company to help prevent the risk associated with working in a dusty environment.

### **Acknowledgments**

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## **Chapter I: Introduction**

Saudi Arabia is known for its well-established oil and steel industries. Unfortunately, most of these industries are located on the country's eastern coast, which is known to be one of the dustiest and hottest regions in the country. These conditions make it hard for employees to perform their duties safely, especially during the day. Saudis are affected by Saudi Arabia's geographical location, climatic conditions, geological nature, soil characteristics, and plant cover characteristics. All of these characteristics make Saudi Arabia susceptible to dust storms. Dust can be environmentally hazardous, which means that it can cause harm to human health. It is a significant health concern at XZY Oil Company. XZY Oil Company is a large company that deals with the extraction and transportation of crude oil. It has oil wells spread in the Empty Quarter desert and has employed numerous employees in those oil wells. Employees working on oil wells in the desert are usually exposed to vast amounts of dust, which is made worse with the ever-occurring dust storms that happen in the desert. Consequently, the type of work the employees have to perform on the oil well requires them to brave dusty conditions in the desert.

### **Problem Statement**

XYZ Oil Company wants to find the best practices to ensure that its employees work in a safe environment. Dust is a big problem, which needs to be addressed for the safety of the employees. The dust has numerous health effects on the health of humans. It affects breathing and leads to breathing-related problems, such as triggering asthmatic attacks when people inhale high amounts of dust particles (Tozer & Leys, 2013). It also causes cardiovascular problems, which can be fatal if there is prolonged exposure to dust particles. Consequently, from scratching your cornea to rupturing your eye, there are a whole lot of things that could go wrong when you get a little bit of something floating on the surface of your eye if you don't take care of it properly (Creekmore, 2016). Thus, XZY Oil Company is

concerned about the exposure of dust particles to its employees working in oil wells in the desert.

### **Purpose of the Study**

The current study will examine the effects of dust on employees working in the oil wells in the desert for XZY Oil Company. Also, the study will look over some of the previously published literature, requirements, and recommendations. Using these data will provide possible solutions to employees working in such environments.

### **Assumptions of the Study**

The following are the assumptions for the study:

1. Employees working in the XZY Oil Company do not have protective safety equipment like dust masks in the oil wells.
2. There will be no rotations of employees working in the oil wells during the study, or employees will not work in shifts.
3. The employees have worked for more than five years in the oil wells.

### **Definition of Terms**

This section defines various terms that are used within this paper.

#### ***Cardiovascular Illnesses***

These terms describe conditions that affect the heart.

#### ***Dust***

This term refers to fine particles which are in the solid state.

#### ***Dust-Storm***

This term is a severe weather manifestation characterized by strong winds and dust-filled air over a large area.

#### ***Environmental Hazard***

This term is a phenomenon or an object that causes problems in the environment.

### ***Protective Personal Equipment***

This term refers to safety gadgets that protect one from hazards, such as harmful sounds and dust.

### ***Respiratory Illnesses***

This phrase refer to illnesses that affect the breathing system, cause breathing problems, and affect the lungs and other respiratory organs.

### **Limitations of the Study**

A few previous pieces of research exist on the effects of dust on employees working in oil wells in dusty environments. This will limit the ability of the study to develop a final literature review, and, therefore, the study will be hindered. The current study will, therefore, seek to identify new gaps in this research topic.

Another limitation is the presence of shifts and irregular working hours of employees working in the oil wells. It will be challenging to collect data because the study will often find different employees. The employees do not meet the inclusion criteria of the research, and it may also be difficult to interview them.

Unpredictable weather patterns in the desert may potentially impact negatively on the study. desert storms may occur irregularly and may, thus, prevent the researcher from carrying out their interview. Due to COVID-19, in-person interviews are hard to conduct, and particular readings at XYZ Oil Company will be hard to obtain. Thus, all interviews will be virtual, and if an on-site safety manager is not available particular air reading will not be obtainable.

### **Methodology**

The study is based on a review of past papers, articles, and web surfing. The main idea is picked up from different electronic and print resources and then elaborated to easily understand this study's central concept. The primary focus of this study is kept towards the

problems that employees face during working in the oil wells. Also, some issues are raised, like no protective measures are strictly adopted. Workers work without taking any severe precautions. If possible, air quality readings at oil well locations will be obtained to conclude with the best available PPE and engineering methods to help employees work safely in dusty conditions.

## **Chapter II: Literature Review**

This chapter will explore various topics related to the current research study and provide a well-informed outline. It will seek to review the literature on the general climatic conditions of Saudi Arabia and the working conditions of outdoor workers in Saudi Arabia. Consequently, it will review laws regarding their working conditions too. Thus, this literature will provide the reader with a general outlook on dust by discussing its relation.

### **Climatic Conditions in Saudi Arabia**

According to Rehman (2009), Saudi Arabia experiences hot and dry climatic conditions throughout the year that affect the lives of Saudis in many ways. Saudi Arabia is arid; the peninsula of Arabia is one of the driest places in the world. During summer, the temperatures rise to about 50°C . During the day, these temperatures are followed by dusty solid winds that blow massively at very high speeds. Additionally, drought is a usual occurrence in Saudi Arabia; there are no rivers or streams. Water present for use is often contaminated with dust in open areas like deserts and oil well locations.

I agree with Rehman; the primary climatic conditions of Saudi Arabia are hot and dry. While there are other climatic conditions, their occurrence is irregularly spread in the Saudi Arabian climate. This uneven spread predisposes the climate to experience desert conditions that are hot and dry, which are presented with dust storms.

The regional models labeled “Hasanean and Almazroui models” disclosed that there had been a decrease in rainfall trends in most regions in Saudi. However, throughout 1978-2009 there has been no trend witnessed in rainfall in the southwestern region of Saudi (Hasanean & Almazroui, 2015). Conversely, Chowdhury et al. (2016) projected that there will be an upsurge of rainfall by approximately 15-25 mm/year in the central, eastern, and western expanses by the year 2050, whereas Al-Zawad projected that the rainfall will increase by approximately 26-35 mm/year throughout 2070-2100.

I concur with Hasanean and Almazroui (2015) because from the meteorological data, it is a fact that the trends in rainfall have been on a sharp decline. Moreover, the Arabian Gulf being almost a desert and its rapid expansion give such a trend. I also concur with Chowdhury et al. (2016) regarding their projection of the climatic situation in 50 years to come. Their projection matches the United Nations Environmental Program, which asserts that the climatic situation will worsen.

In the southwest expanse, Chowdhury et al. (2016) projected that there will be a rainfall escalation in 2070 of about 109.7-130.4 mm/year, whereas Al-Zawad projected an upsurge of 96.7 mm/year. While using the rectilinear and Mann-Kendall (M-K) trends, Rehman and Al-Hadrami described that the west coast of Saudi experienced life-threatening temperatures. Consequently, their study exhibited an upsurge in temperatures during the summer and an overall increase in the number of sweltering days every year, owing to the perchance that they are common effects of greater upsurges in temperature lesser precipitation during summer.

Also, Hasanean and Almazroui (2015) note that, in the future, the mean annual thorough going temperature may escalate at an elevated rate than the mean annual lowest temperature. Moreover, Almazroui stated the upsurge of temperature by  $0.65^{\circ}\text{C}$  per period while the dominant region to the coast of the Red Sea would be somewhat affected by the augmented extreme rainfall happenings. All these studies raise a climate concern for when the dryness of the weather in Saud Arabia increase, it will increase the dust and make desert oil well work unsafe.

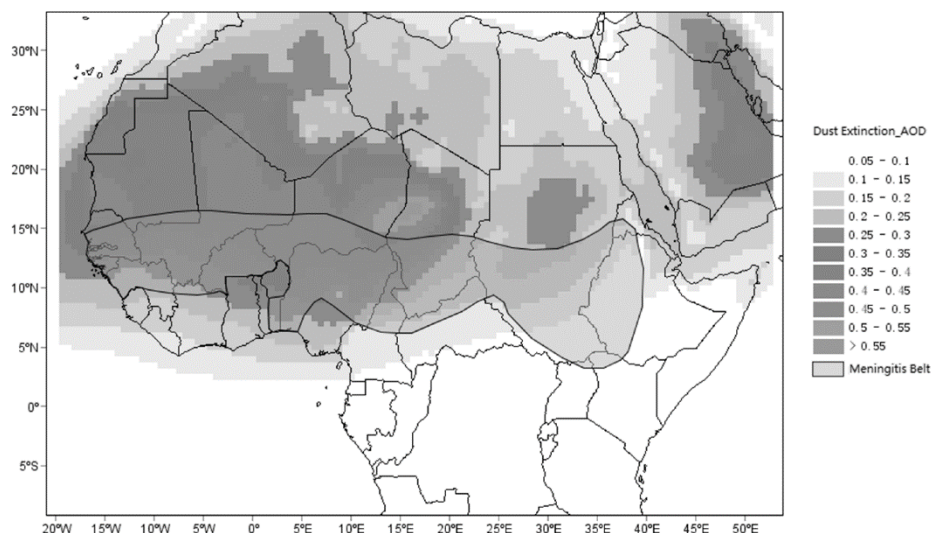
### ***Causes of Hot and Dry Climatic Conditions in Saudi Arabia***

Rehman (2009) notes that because Saudi Arabia is located in the desert of the Middle East, it is prone to harsh weather conditions. The weather therein is usually hot and dry during the day, but it gets freezing and moist at night. Strong winds blowing in the desert

make the atmosphere dusty and unbearable, especially in the afternoon. In April 2018, Saudi Arabia experienced the worst dust storm. It was an enormous dust storm since it stretched to approximately 500 kilometers. Sandstorms that are this large are usually fueled by strong winds that emanate from the northwestern side, which is the location of the Arabian Peninsula desert. Thus, Saudi Arabia's position in the desert prompts it to have dusty weather throughout various seasons like summer. Saudi Arabia is located in one of the dustiest locations in the world (see Figure 1).

**Figure 1**

*Dustiest Areas in the World*



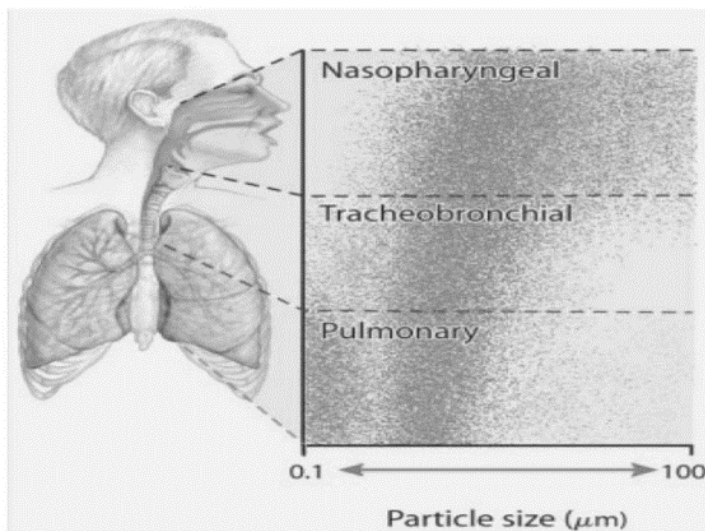
*Effects of Hot And Dry Climatic Conditions*

Moda and Alshahrani (2018) assert that hot climatic conditions in Saudi Arabia have been associated with windy conditions. These blustery conditions, after that, cause dust and sandstorms, which reduce visibility and may lead to accidents on the roads and job fields. During the summer, a majority of accidents have been associated with such poor visibility. Also, dust and sandstorms reduce workers' productivity by lengthening rest periods and, thereby, dragging the time of finishing a project. Dust and sandstorms also pollute the air. This may be problematic for people with lung diseases like asthma and obstructive pulmonary disease.

According to Hsieh and Liao (2013), airborne dust particles are transported via air inhaled through the nose or mouth and passed to the lung tissues via the trachea. The respiratory system may be divided into three regions (i.e., nasopharyngeal region, tracheobronchial region, and bottom lung tissue region) and particle size deposition roughly correlates with diseases in these regions. The human respiratory system and the type of risks according to the particle size are shown below (see Figure 2).

## Figure 2

### *The Human Respiratory System and Health Risk*



Meo et al. (2013) found that the  $\text{PM}_{10}$  and  $\text{PM}_{2.5-10}$  pollutants in the Saharan dust increased the risk of visiting the health emergency department by 9.1% and 4.5%, respectively, for children with asthma Guadeloupe. Meo et al. (2013) reported severe asthma attacks in volunteers in Riyadh, Saudi Arabia, caused by sandstorms; they found that subjects exposed to sandstorms developed asthma and that the frequency was noticeable in 20.9% of cases. The study clearly shows the correlation between sandstorms (i.e., dusty conditions) and severe health issues. The severity of the asthma attacks depends on the location of the storm, the amount of dust the volunteers were exposed to, the concentration of dust particles, and the

PPE the volunteer used at the time. Generally, few studies focus on the association between asthma and dust events; therefore, more studies should be conducted.

Asthma is not the only problem found to be related to the dust storm. Korényi-Both et al. (1992) emphasized that various kinds of pathogenic organic components of Saudi sand dust contributed to an opportunistic infection of pneumonitis. They are not the only ones to find a correlation between dust and pneumonia. Uduma and Jimoh (2013) found the exact correlation in Kano state, Northwest Nigeria, during Sahara dust events.

Other respiratory diseases are caused by dust storms, deteriorated pulmonary function, nonindustrial pneumoconiosis, desert lung syndrome, and Chronic cough. These diseases have been found by several studies, such as Derbyshire (2007), Gwack et al. (2005), Matsumoto et al. (2012), and Yoo et al. (2008). Also, Koh et al. (2018) found that Chronic obstructive pulmonary disease (COPD) is one of the primary diseases caused by dust.

Lelieveld et al. (2015) conducted research using a global atmospheric chemistry model that suggested that outdoor air pollution leads to 3.3 million premature deaths per year worldwide, with natural sources of particulate material (predominantly desert dust) responsible for 600,000 (18%) of those deaths.

In large parts of North and East Africa, the Middle East, Central Australia, and Central Asia, natural sources of small particulate material, such as desert dust, contribute to mortality than more recognized pollution sources, such as industry, traffic, energy, and agriculture. Thus, understanding the link between desert dust inhalation and mortality and the climatic factors that influence airborne dust levels is key to disease control in affected areas.

According to Mosly (2015), construction workers are a group of people that are mainly affected by heat exposure, heat stress, and dust. Exposure to much heat has been known to affect people with skin cancer and other skin-related conditions. Dust, on the other hand, has been known to affect construction workers' health. The article reveals that most

workers working during the daytime and in summer experienced lung-related health conditions and frequently complained of chest pains. It was because of dust. Moreover, they complained that they could not see well and, thus, had to take off from work for some time.

The conditions previously highlighted can be brought to encompass an urban heat island. An urban heat island (UHI) is a metropolitan expanse that displays greater temperatures when likened to the country or out-of-town ambiances (Alghamdi & Moore, 2014). Saudi Arabia can, thus, be categorized as an urban heat island since a majority of its regions like Mecca and Riyadh experience extremely high temperatures than any other region.

According to Alghamdi and Moore (2014), the UHI effect in Saudi Arabia is due to numerous influences, for instance, air pollution, high temperatures, urban construction, and disparities in rainfall patterns. The UHI influences the health of humans via exposure to augmented temperatures and, therefore, can be challenging, especially in the course of heat waves. These heat waves usually have a pronounced effect on outdoor workers more than indoor workers in Saudi Arabia. Even though the UHI effect distresses the general public, there is a similar prerequisite for attention to be placed on its effects on the health of outdoor workers. Heat exposure has remained formerly connected to several nasty effects on workers' health, from exacerbating trifling conditions like overall discomfort, heat spasms, respiratory problems, heat stroke to amplified likelihoods of hospitalization, and not forgetting death.

Moreover, the heat island effect is partially answerable for the present temperature variation in many metropolises in Saudi Arabia. Outdoor workers like traffic custodians, fire combatants, people who sweep roads, landscapers, minor traders, and most importantly, workers who toil in oil deposits in the desert and many other workers are the most affected by heat island effects (Chowdhury et al., 2016). They face an added 3°C-5°C upsurge in

temperature throughout the hottest time, which will render their work very heavy and quite challenging.

When employed in a hot setting, workforces (together with healthy ones) are under significant strain. Their perspiring (i.e., body's conserving mechanism) efficiency is a bridge to the inadequate movement of air in the direction of the skin. Additionally, the shielding outfit used by workforces which shields them from getting into contact with chemicals, shock, and additional contaminants, may deter evaporative loss of heat; further, plummeting the perspiration effectiveness (Chowdhury et al., 2016). Another influence that may upsurge UHI is the inadequate consumption of water, which leads to dehydration and consequently lessen perspiring and resultant heat loss. Dehydration also contributes to the impairment of mental and physical performance.

Numerous studies have stated that the overall effects of climate change, and more specifically, hot and dry climatic conditions in Saudi Arabia, are devastating. They have, for some time, affected the accessibility and quality of resources of water. They have augmented ill health and death owing to thermal excesses, epidemics, starvation, the topographical, and periodic spread of communicable, vector, rodent-borne diseases, as well as cardiac and respiratory diseases.

In the previous three epochs, hot, dusty, and dry climate-associated diseases were liable for about 150,000 deaths and about one million disability-adjusted life years (DALYs) in the more incredible Arabian Gulf. The Intergovernmental Panel on Climate Change (IPCC) of Saudi Arabia has elucidated that all these happenings are due to climate change. Thus, the government should elucidate measures to reduce susceptibility in terms of exposure to hazards and enhance the capability of workers and the general population of Saudi to adapt to these changes. Moreover, being thoughtful of the relations between climatic strictures and the environment is prospective in reducing susceptibility, such as growing more vegetation to

prevent dust storms from carrying the topsoil, thereby causing undesirable health effects in the environment. Consequently, the upsurge in temperature might be changed to liquefied oxygen and escalate dissolved organic matter (DOM) and salinity in foundation water. This, therefore, affects the quality of water in many Saudi Arabian homes and workplaces. Generally, the hot, dusty, and dry climatic conditions in the greater Arabian gulf affects the quality of life for the oil well workers in Saudi Arabia.

Previous studies have reported that there will be an increase in the demand for resources, such as water, by approximately 5%-15% in 2059. This is accredited to an increase in evapotranspiration. An upsurge of temperature by a degree may alter the thermal parameters by approximately 10%-30%, which might thrust the crop above the edge and upset harvest yields (Alghamdi & Moore, 2014). Thus, temperature upsurges in Saudi Arabia continue to rise day by day, posing threats to oil well workers.

I concur with Mosly (2015) since construction work is more demanding and necessitates working outside for more extended periods. This, in Saudi Arabia, may affect certain people with sensitive skin. Moreover, it is known that people with skin cancer are more susceptible to the sun's radiation. Additionally, dust is a problem for oil well workers, and the study has explicitly highlighted the problems.

Besides, I back up the studies done regarding the projection of temperature increases in Saudi Arabia in thirty or forty years to come. This is because they reflect the current situation in the greater gulf and zoom it in Saudi Arabia. Generally, Saudi's hot, dusty, and dry climatic conditions will worsen and affect the oil well workers.

### **Outdoor Workers in Saudi Arabia**

Given the country's hot and dry climatic conditions, the Saudi government enacted specific laws to protect outdoor workers. The government realized that outdoor workers, like construction workers, workers working in oil wells in the desert, and other field workers were

exposed to harsh weather conditions like extreme sunlight and gusty winds. The government, therefore, came up with several laws and regulations that employees should enforce in their workplaces for outdoor workers (Mosly, 2015). Part of the laws regards rotations and shifts in workplaces and the law restricting certain working times for outdoor workers.

### ***Law Regarding Rotations and Shifts***

The extent to which several republics usually address the requirements of their shift workforces through parameters varies. Sanni-Anibire et al. (2018) assert that most systems control elementary stuff like paying extra for nocturnal labor. However, some governments essentially address the physical hazards of nocturnal and shift labor unswervingly. In Saudi, some firms address the issues directly by enabling workers to rest in between working hours. However, other firms do not usually adhere to these standards; they only pay workers extra for their toil (DLA Piper, 2021). Thus, it is by no means universal for countries to incorporate shift laws in shift labor. It can, thus, be asserted that many codes of practice do not essentially address all the desires of shift workforces, and in any case, they do address the needs. Efforts are usually made for them to meet those needs, of which they are infrequently methodical.

Definite response to the prerequisites of the shift workers is rested on the variability of peripheral aspects. For instance, in Saudi Arabia, the cost of ratifying and implementing defensive regulation might be superior and weighty than the benefit to the shift workforces. This may also be predominantly factual in less-developed nations, where stringent procedures on shift labor may well be appropriate to low desirable economic growth (DLA Piper, 2021). Conversely, in other nations, high salaries make mechanization a feasible decision in particular segments. Thus, shift labor could be abridged with a slight economic impact.

The Saudi Arabian occupational health law provides that employers ensure shifts and rotations for their workers engaged outside a building or in open places. Shifts will give resting time for these outdoor workers and prevent them from spending too much time being

scorched in the sun. Consequently, it will prevent them from being exposed to too many dusty storms, which might negatively impact their health during the day (Mosly, 2015). Moreover, this law aims to protect outdoor workers from extreme cold conditions at night since the climatic conditions of Saudi Arabia during the night are always icy.

### ***Restriction of Working Time***

According to Al-Bouwarthan et al. (2019), the Saudi government has placed restrictions on working hours between noon and 3 p.m. for public sector workers. Employers should ensure that no outdoor workers should be at their workstations during this time. All employers that have their employees working in outdoor environments are aware of this law or policy, and if they are found breaching it, they are liable to face legal action. Besides, employees are made aware of the policy, so it is their right to demand to be relieved from duty when that time comes. However, Kadasah (2015) asserts that exceptions can be made in an emergency and if the employer provides the workers with appropriate protective personal equipment (PPE).

A regulation labeled "Midday work break 2019" has kicked off operations as of June 15, 2019. It is expected to lapse for three months, and then it is reviewed again. This law applies to workers in the private sector, and the three-month midday work break prohibits outdoor work throughout the months of hot summer between 12 p.m. and 3 p.m. (Construction Week, 2019). The Ministry of Labor and Social Development, in a circular sent to all private sectors involved in outdoor work, asserted that

local employers must regulate working hours and comply with the labor mandate designed to ensure workers' health and safety. The labor ministry's rule will apply to private-sector companies and establishments in Saudi Arabia until the months of hot summer ends. However, the rule will exclude oil and gas workers and some

governorates in the kingdom where temperatures do not require such restrictions.

(Construction Week, 2019)

These references are correct in that Saudi Arabia has made much effort in ensuring that employees work in a safe condition at the workplace, and I concur with them, particularly on these laws.

### **Personal Protective Equipment**

According to Mosly (2015), personal protective equipment is worn to reduce exposure to hazardous materials in the workplace that can cause injury and illnesses. Employers should ensure that they provide their employees with the correct protective personal equipment. Employers should examine working conditions at workplaces and decide which PPE is suitable for designed working stations. Dusty working conditions or workplaces that are out in areas likely to experience dust storms are dangerous. The employees therein should be given clothing to protect them from contracting illnesses associated with dust that may affect the lungs and generally cause breathing problems. In the case of working in a dusty environment like in oil wells in the desert, employees should demand PPE like goggles and gas masks.

Additionally, Ahmad et al. (2017) weighs in and asserts that employees should ensure that they wear or use their PPE appropriately to minimize the risk of injuries or reduce the impact of hazards. This is because personal protective equipment only works well when they are worn or used well. Protective personal equipment protects one's various body parts from many hazards that are present in the workplace. For instance, they protect the lungs against contaminated, poisonous, and dusty air. Since Saudi is very dusty, PPE-like gas masks should always be provided to outdoor workers. Some technology-enhanced gas masks filter the dusty air, and the wearer inhales the air free from dust pollutants.

Generally, PPE makes sure that the wearer receives little or no injury from hazards present in the workplace. Both sources note the importance of using PPE in the workplace, and their claims are valid.

### ***Types of Hazards in the Workplace***

Different workplaces expose workers to different kinds of chemical, physical, ergonomic, and psychosocial hazards. These types of hazards inflict various types of injuries to workers in diverse workplaces. Chemical hazards are found in industrial chemical plants and comprise fumes or harmful chemicals. These types of hazards are ranked as the most harmful hazards of all the other kinds. This is because they often cause irreversible physical damage or incapacitation to people (Mosly, 2015). Employees should, therefore, ensure that a workplace is safe from chemical hazards and provide the correct PPE to its employees to reduce the impact of these types of hazards.

Physical hazards can be found in almost all working environments: slippery floors, dangerously hanging wires, dust, stones, and pebbles. Ahmad et al. (2017) mention that these hazards can also cause serious health effects like physical injuries that may render one paralyzed. It is difficult to avoid these types of hazards because they are virtually everywhere. However, designing a workplace to minimize these hazards is the best way to counter them. The source is precise on what the hazards cause on people; at times, there have been reports of stones falling on people abruptly in workplaces and killing them.

Ergonomic hazards occur because of physical hazards. For instance, if workers are used to lifting heavy objects, they may sustain musculoskeletal injuries (Mosly, 2015). Here, Mosly (2015) asserts that lifting heavy objects in most construction sites may cause an ergonomic hazard that may present itself with musculoskeletal injuries. I concur with the reference because construction sites are customarily associated with the lifting of heavy objects and, so, may cause such injuries. Also, these hazards usually occur in workplaces,

where employees do a lot of tedious and back-breaking jobs. They may also be found in white-collar job workplaces where there is much sitting and little or no movement.

Lastly, Mosly (2015) notes that a psychosocial hazard, such as stress is the major problem that one may acquire at the workplace. These hazards occur because the work environment sometimes becomes stressful. For instance, one is often expected to complete tasks within specified deadlines, and also sometimes, an employer expects much output from employees. These expectations and deadlines cause this type of hazard. Indeed, stress is a psychosocial hazard mainly associated with workplaces that present with tedious workloads and deadlines. Thus, I concur with the source on its claims that these types of hazards are a significant problem in workplaces.

#### **Identification of Potential Hazards Associated with Well Drilling Activities**

Saudi oil and gas enterprises have appeared in the below table. As per the outcome, 38% respondents from Saudi Arabia oil and gas industry, 48% which is most noteworthy is from Pakistani coastal oil, 28% from Malaysia and gas industry considered compound peril is likely danger during great penetrating activity. Essentially, 60% of them from Malaysia and 30% from Saudi Arabia, and 45% from Pakistani oil and gas enterprises indicated that the compound peril is significant for wounds during seaward well penetrating activity.

While, from the Malaysian inland oil and gas industry, 72%, Saudi Arabian 62%, and Pakistani 52% showed that well-being risk is a possible danger. Same as, 40% of them from Malaysia and 60% from Saudi Arabia, and 55% from Pakistani oil and gas businesses indicate that well-being peril is a potential hazard (see Table 1).

**Table 1***Well-being Peril are Potential Hazards*

Countries	Domain	Chemical hazards %	Safety hazards %
Saudi Arabia	Onshore	38	62
	Offshore	40	60
Pakistan	Onshore	48	52
	Offshore	45	55
Malaysia	Onshore	28	72
	Offshore	60	40

**Impact of Exploration, Drilling, and Extraction**

Oil investigation, penetrating, and extraction are the principal stage of what the business calls the upstream stage in the long-life pattern of oil. There are around 40,000 oil fields on the planet, and there have been more than 4,000 new oil investigation licenses conceded in the previous 10 years. Increasingly disorganized and costly cycles for finding oil stores in far-off and cold areas, carrying the oil to the surface, and getting it to a market have significant natural, social, and well-being impacts. The actual modification of conditions from inspection, penetrating, and extraction can be more noteworthy than a vast oil slick. Significant effects incorporate deforestation, biological system crushing, synthetic defilement of land and water, long haul damage to creature populaces, human well-being and dangers for adjoining networks and oil industry workers, and removal of native networks. Investigation and extraction additionally produce voluminous measures of strong squander known as penetrating squanders and related squanders. In spite of the fact that related squanders comprise a generally slight extent of absolute wastes, they are destined to contain a scope of synthetic compounds and normally happening materials that are of worry to well-being and security (O'Rourke & Connolly, 2003)

**Law Regarding PPE in Saudi Arabia**

Provisions on personal protective equipment are embedded in the Saudi labor laws. Therefore, the labor ministry makes sure that employees are provided with PPE while in the

workplace. Kadasah (2015) notes that PPE is part of occupational and safety health laws (OSH) not only in Saudi Arabia but also in most countries across the world since the International Labor Organization (ILO) enacted the laws. Therefore, in 2005, the Saudi government amended labor laws that stated that employers should minimize workplace risks by providing workers with appropriate PPE and ensuring that they are in good working condition and suited for the jobs. Kadash is correct in noting that PPE has always been part of international OSH laws, used by about all countries in the world.

Alshahrani et al. (2014) affirm that PPE usage and directive to employers to enforce it is also contained in the LEGOSH document. This legal document highlights much information concerning PPE for both employers and employees. Among them is that employees have a right to demand the provision of PPE from their employers. Subsequently, Kadasah (2015) asserts that the document avows that legal action shall be taken against employees that do not provide PPE to their workers.

The document also says that employers will be liable for any damages or accidents to their employees. If an employee suffers a debilitating condition, the employer will take care of the employee until they recover. Generally, the two references are factual in their claims that the LEGOSH document aims to protect the safety and welfare of employees in Saudi Arabia and prevent employers from mistreating its employees.

Ahmad et al. (2017) assert that the Saudi Standards, Metrology, and Quality Organization (SASO) recently published specific technical regulations that should be applied for PPE and their consequent clothing. It gave the directive that the regulations should take effect immediately. Also, SASO asserted that manufacturers should recall PPE made after releasing these regulations and repair them to conform to the SASO regulations. The regulations, thus, state that PPE should be supplied with instructions of usage, storage, and maintenance. They should also have clear risk warnings wherever appropriate; the products

should be well labeled Arabic and English. The labeling should be very much readable. I concur with the source since these regulations are essential for manufacturers and PPE clothing companies; they help them set safety standards for manufacturing PPE.

### **PPE in the Workplace**

Even though PPEs are utilized as the last measure for working environment dangers control and are utilized for the situation where administrative and designing control measures are set up. PPEs are the fairest proportion of security for workers in limited scope enterprises where traditional dangers control measures and projects remain a test to execute. Non-utilization of PPEs can open workers to numerous dangers. PPEs can assume an essential job in limiting word-related wounds and mishaps, which in any case bring about considerable human sufferings and monetary misfortunes because of brought down creation, heavy fines, well-being and protection cases, and truancy (Balkhyour et al., 2019). Kadasah (2015) affirms that different kinds of PPE cater to various work conditions and environments. PPEs are made of materials that are strong enough to withstand hazards. Such equipment includes face shields, gloves, goggles, glasses, gowns, and headcovers.

Face shields protect one from the splash of chemicals, which may destroy the face and the eyes. While goggles and glasses offer additional protection to the eyes (Sanni-Anibire et al., 2018), gowns and headcovers protect vital body organs against all types of hazards. The reference gives some examples of PPE, which are primarily used in the majority of workplaces. Therefore, I agree with it since it highlights the most common PPE found in many workplaces.

### ***Consequent Clothing***

It gave the directive that the regulations should take effect immediately. Also, SASO asserted that manufacturers should recall PPE made after releasing these regulations and repair them to conform to the SASO regulations. The regulations, thus, state that PPE should

be supplied with instructions of usage, storage, and maintenance. They should also have clear risk warnings wherever appropriate; the products should be well labeled Arabic and English. The labeling should be very much readable. I agree with the source since these regulations are essential for manufacturers and PPE clothing companies; they help them set safety standards for manufacturing PPE.

### **Chapter III: Methodology**

Dust is one of the most common environmental problems in Saudi Arabia, particularly to companies that demand outdoor activities. Saudi Arabia is located in the Arabian Peninsula and the Arabian desert. Thus, it experiences one of the harshest environmental conditions when it comes to dust problems. Also, employees working in outside environments and during the day are usually affected health-wise when it comes to dust issues. XZY Oil Company is a large company that demands its employees to work in its oil wells located in the desert. Therefore, they experience damaging health impacts because they have to face dusty conditions. Consequently, this research sought to determine the effects of dust on employees working in oil wells in the desert for XZY Oil Company and provide possible solutions to employees working in such environments.

This research required various data collection methods that sought to find the views and attitudes of employees working for XZY Company, particularly employees working in oil wells in the Arabian desert. Thus, the data collection methods that were used comprised interviews, questionnaires, and similar case studies. Therefore, it required qualitative data since this research sought to find out the effects of dust from the employees' point of view and their attitudes towards working in such environments. Consequently, this data was less numeric and more of finding views or opinions of employees and any other credible research participant.

The data collection procedure involved the use of specific steps. The first step involved determining the information to collect, whereby the researcher settled on collecting data about the number of employees affected by dust in XYZ company and who had lodged complaints regarding their health. The subsequent step that the researcher undertook was to set a time frame for data collection since the employees' working hours were during the day.

Additionally, since the interview method required continuous data collection, the set time frame was suitable for interviewing the employees.

The resultant steps involved the actual data collection and the analysis as well as interpretation of the collected data. During the collection of data, the research ensured that they maintained the ethics of research. This was done by not requiring the participants to write their names on the questionnaires and explaining what the research entailed in great depth.

The researcher, in its attempt to study the employees, had to use a sampling method. The sampling method used was a probability sampling method that was a random sampling technique while making sure all employees were from a desert working group.

This technique randomly selected the employees working in the oil wells, so the sample size that the researcher settled on was 50 employees. All these 50 participants were randomly selected, interviewed, and given questionnaires to fill.

## Chapter IV: Results

This chapter evaluates the results found from the survey regarding oil workers at XYZ company performing their work in dusty conditions. The result will show the knowledge of workers regarding PPE and other protection methods. Also, the survey will describe the number of employees who are aware of the health risks associated with working in dusty conditions. The first part of the survey focuses on the demography of the workers, the second part is about work conditions in general, and the third part is about the PPE and other safety-related questions.

### Demographics

Out of 150 employees at XYZ company, the researcher decided to choose a 30% sample due to the limitation of time and other limitations related to the current pandemic. The first part will focus on the demographics of the surveyed workers and was used to understand the background and knowledge of the selected group. The distribution of age, gender, education, background, and work experience is illustrated in Table 2.

**Table 2**

*Socio-Demographic Survey Results for XYZ Oil Company Employees*

Question	Answer	Percentage
Gender	Male	100
Age	18 to 29	62
	30 to 40	34
	41 to 50	4
	51+	0
Education	High school	40
	Diploma	24
	Undergraduate	36
	Higher education	0
Work experience at the company	1 to 5 years	30
	5 to 10 years	56
	More than 10 years	14

Looking at the data shown in Table 2, we came to learn that a significant percentage of the group selected is under 30 years old. While it is a subjective matter, age makes a

difference in risk-taking. The younger the worker, the more likely the worker will take more risks and the more likely to work in bad weather conditions. The motivation can be to impress his boss, gain reputation among others, or for financial reasons. All of which must be controlled by the company to ensure the safety of the workers.

The other primary metric was education. Forty percent of the workers said that they have a high school degree only. From the researcher's perspective, workers who have no work experience and rely only on a high school education might face a bigger problem than others with higher education. Usually, high schools do not teach students the proper technique for the work oil rigs need. From a safety standpoint, these workers need to receive the proper training before working in the desert. During the interview, workers with diplomas and higher education degrees said that their jobs are related to their degrees. This means that they have more knowledge regarding the work they are performing than the workers who had no work experience and only received high school degrees.

### **Work-Related Survey**

Table 3 shows the survey's findings regarding the work conditions at the oil rigs. Also, it shows the weather conditions these workers had to work in while performing their oil rig duties.

**Table 3***Work background, Health, and Risk Awareness Survey Results*

Question	Answer	Percentage
Working in the desert	Yes	100
	No	0
	Prefer not to say	0
Working more than one week in the desert monthly	Yes	58
	No	38
	Prefer not to say	4
Working in dusty weathers	Yes	62
	No	30
	Prefer not to say	8
Worked for more than five years	Yes	52
	No	46
	Prefer not to say	2
Had the proper training to work in dusty conditions	Yes	4
	No	68
	Prefer not to say	28
Aware of risks of working in dusty conditions	Yes	72
	No	18
	Prefer not to say	10
Reduced working hours in summer	Yes	12
	No	72
	Prefer not to say	16
Any health issues due to working in dusty conditions	Yes	12
	No	68
	Prefer not to say	20

From the result, we can see that many workers said that they work for more than a week every month. This increases the possibility of the worker having to work in dusty conditions. Also, since most workers said yes to working in dusty conditions, these workers are at high risk of potential health problems, especially those who said that they worked for more than five years. The main idea of this second survey is to understand the working conditions for the selected group, which is 30% of the total workers at XYZ company.

Preparing workers for such a working environment is essential not only for workers' health but also for the quality of work they are performing for their company. According to 68% of workers, the lack of proper training is a problem for both the company and the workers. By the time this survey was conducted, 12% of workers had experienced some

health issues working in dusty conditions. The company should consider giving workers more breaks since the same workload is being performed during summer. Summer is a hug that contributes to the dusty weather in the desert in the Middle East.

### **PPE and Safety Survey**

The result of the survey given to the workers regarding their PPE and safety equipment is shown in Table 4.

**Table 4**

#### *Protection and Surveillance Behavior Survey Results*

Question	Answer	Percentage
Use of a mask	Yes	24
	No	54
	Prefer not to say	10
Use of goggles	Yes	80
	No	14
	Prefer not to say	6
Use of special clothing	Yes	12
	No	58
	Prefer not to say	30
Use of gloves	Yes	78
	No	18
	Prefer not to say	4
Safety managers regular check	Yes	22
	No	54
	Prefer not to say	24
The company provide PPE and maintain them in good conditions	Yes	18
	No	64
	Prefer not to say	18

From Table 4, we learned that more workers do not wear a face mask which is one of the most critical PPEs for working in dusty conditions. The face makes and other PPEs are neglected mainly for two reasons: the lake of knowledge and proper training and the lake of surveillance. Fifty-four percent of workers said that the safety manager does not regularly check on their PPE to ensure the workers are using the PPEs.

One of the essential factors in making sure the workers at XYZ company bring safe is by providing the workers with PPEs and making sure they are in good condition. The lack of surveillance, PPEs, and maintenance is putting the workers of XYZ in great danger.

In general, the results of this study showed that a significant improvement at XZY is needed to ensure the safety of their workers. In the next chapter, some recommendations will be presented to help XYZ company maintain the health of the workers.

## **Chapter V: Conclusion and Recommendations**

This section provided the implications of the research; the research findings have been incorporated and interpreted to reveal the pattern. Furthermore, recommendations on how the study can be facilitated better in the future have been provided. This is essential in revealing the approach that can curb research challenges encountered during the study.

### **Conclusion**

The economy of Saudi Arabia is intensely subject to oil. The private area has put forth impressive attempts to advance well-being, security, and climate through deliberate software engineers and cost decrease activities to enhance profitability. For example, item stewardship and the oil and gas industry's Responsible Care Programmed; non-administrative general well-being, natural associations, and worker's guilds have been established. Other common society associations have made significant commitments to the advancement of security. Progress in administration and proficiency improvement has not, nonetheless, been adequate, and the climate cross country keeps on experiencing air, water, and land pollution, weakening the well-being and government assistance of Saudis. The need to make a coordinated move is emphasized by a broad scope of exploration and creation advancements and handling well-being worries at the global level. This incorporates an absence of limit concerning overseeing dangers, reliance on oil field security, presentation of workers to unsafe oil fields, and worry about the long-haul impacts on both human well-being and the climate. The specialists at XYZ company need a tremendous amount of change. XYZ company and other oil companies are great contributors to the overall economy of Saudi Arabia. However, the procedure followed at the XYZ and other oil companies needs to be more efficient. This is due to the unsafe working condition Saudi Arabia faces occasionally. The study found different issues at the company, which, if addressed, will help improve the safety of the workers and the ROI of the company. The lack of surveillance and proper training of workers are series of matters

XYZ company must look at. Workers in the oil and gas extraction industry keep on being one of the most elevated in danger of wounds and fatalities at work contrasted with any remaining ventures. These factors can ultimately affect worker safety by causing an increase in human error, including misuse of equipment and inconsistent procedures that can lead to a higher chance of accidents. (Manufacturing.net, 2017).

### **Recommendations**

The points in this section suggest how this study can be facilitated in the future to overcome the research difficulties encountered during the study.

#### ***Proper Training***

XYZ company should start implementing an extra training program for all workers expected to work in a dusty condition. This is going to increase the safety of the workers as well as the efficiency of their job. Before work begins, ensure everyone conducting work understands their role, hazards that exist, and all safety precautions. Require procedures and hazards to be fully communicated to new workers in the event of shift handovers and worksite changes (Manufacturing.net, 2017). Familiarizing the workers with the working conditions can save their lives and prepare them physically and mentally for the expected job. Managers should set arrangements, give hardware, and set up designing controls. However, workers likewise have a significant task to carry out. Managers should also try to cover the limits of respiratory assurance hardware. Their preparation should cover what they need to know to protect themselves. Since the workers will be working in oil rigs, managers should utilize the OSHA support exercises in their Oil and Gas Well Drilling and Servicing eTool.

#### ***PPE and Other Safety Equipment***

XYZ company must provide each worker with proper PPE and other safety equipment needed. Also, they should communicate the importance of these PPE. XYZ safety manager must perform regular maintenance on each piece of equipment to ensure the equipment is in

good condition. The manager should also communicate any PPE concerns to the management to make proper arrangements.

### ***Execute a 5S System***

This recommendation is essential in improving the work process, and lessening squanders with a 5S framework. Apply vital marking procedures to coordinate, caution, and convey a wide range of data to workers. Shading codes materials in the working environment to make them simpler and quicker to discover, including explicit devices and gear, is only the tip of the iceberg (Manufacturing.net, 2017). Using the 5S system can be adjusted to suit the XYZ company's worksite. Train the workers on different signs to convey the right message in case of heavy dust storms.

### ***Changing Shifts and Duration of Work***

The employees' shifts should be revised; employees should work in shifts between 8 am and 5 pm. This would reduce their exposure to dust in dusty environments. The company should also give more breaks between duties; the researcher found out that the employees were only given about 10 minutes or so by their supervisor, which was not sufficient. During summer, workers should be offered proper clothing and reduced schedules. Saudi Arabia is well known for dust storms during summer. Additionally, whenever possible, the company should move workers from rig jobs to office jobs to rotate the workers and limit the dust and sun exposure.

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## Appendix

### Survey

The following are the survey questions asked during this study:

1. What is your gender?
  - a. Male
  - b. Female
2. How old are you?
  - a. 18-29
  - b. 30-40
  - c. 41-50
  - d. 51+
3. What is your highest level of education?
  - a. High school
  - b. Diploma
  - c. Undergraduate
  - d. Higher education
4. Check the response that shows your work experience at this company
  - a. 1 to 5 years
  - b. 5 to 10 years
  - c. More than 10 years
5. Do you work in the desert?
  - a. Yes
  - b. No
  - c. I prefer not to say

6. Do you work for more than a week in the desert? (Every month)
  - a. Yes
  - b. No
  - c. I prefer not to say
7. Have you been working on oil rigs for more than five years?
  - a. Yes
  - b. No
  - c. I prefer not to say
8. Have you been given proper training on how to work in dusty weather?
  - a. Yes
  - b. No
  - c. Prefer not to say
9. Have you been given proper training on how to work in dusty weather?
  - a. Yes
  - b. No
  - c. Prefer not to say
10. Are you aware of the potential risks of working in dusty weather?
  - a. Yes
  - b. No
  - c. Prefer not to say
11. Does your company reduce the workload during summer?
  - a. Yes
  - b. No
  - c. Prefer not to say

12. Have you experienced any health issues caused by working in dusty weather?

- a. Yes
- b. No
- c. Prefer not to say

13. Do you work during dusty weather?

- a. Yes
- b. No
- c. Prefer not to say

14. Do you wear a mask when working?

- a. Yes
- b. No
- c. Prefer not to say

15. Do you wear goggles when working in the desert?

- a. Yes
- b. No
- c. Prefer not to say

16. Do you wear any special clothes designed for working in the desert?

- a. Yes
- b. No
- c. Prefer not to say

17. Do you wear gloves for working in the desert?

- a. Yes
- b. No
- c. Prefer not to say

18. Does your company provide PPEs and replace them regularly?

- a. Yes
- b. No
- c. Prefer not to say

19. Does your safety manager check on your PPE regularly?

- a. Yes
- b. No
- c. Prefer not to say