Analyzing the Determinants of Latent Psychological and Physical Causes of Occupational Accident Proneness: A Field Study at the Bir el Ater Phosphate Complex

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Abstract: This study aimed to explore the underlying psychological, and material factors that contribute to the occurrence of occupational accidents and their targeting within the phosphate complex in the city of Bir El Ater. A descriptive-analytical method was adopted through a quantitative field study based on the content analysis of guided interviews, statistically coded and supported by a complementary questionnaire and accident records. The sample consisted of 60 workers deliberately selected from categories most exposed to accidents. The results revealed significant psychological difficulties (such as anxiety, routine, fatigue, and mental distraction) and a weakness in adherence to occupational safety and protection measures. In addition, harsh physical conditions (dust, heat, cold, noise, and rain) collectively contribute to increasing the likelihood of occupational accidents and the targeting of certain workers.

Keywords: psychological factors; material factors; occupational accidents; accident targeting

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1-Introduction:

The study of occupational accidents and the proneness to them is of paramount importance for understanding their underlying causes and developing effective prevention strategies, An examination of the latent psychological and physical causes behind these incidents is essential, as these factors are often not openly discussed by workers or organizations, Therefore, this study aimed to explore and analyze these hidden causes, presenting a field study approach to uncover the psychological and physical factors contributing to occupational accident involvement or proneness.

The motivation for selecting this topic stems from the high rates of occupational accidents, which continue to pose significant risks to worker health and productivity, While these incidents are often attributed to direct causes such as human error or equipment failure, they may also be driven by deeper, less apparent psychological and physical factors that are not always acknowledged in occupational safety protocols, By focusing on these latent causes, this study seeks to illuminate a frequently overlooked aspect of occupational health and safety, one that could ultimately lead to improved accident prevention and management in the workplace.

Furthermore, the Djebel Onk Phosphate Complex in Bir El Ater, a major industrial center, provides a unique and valuable context for investigating the interplay between psychological and physical factors in the occurrence of occupational accidents and proneness to them. Given the complex nature of the work environment and the risks associated with the industry, this study aims to provide actionable insights for enhancing safety measures and mental health awareness among workers, This research is grounded in existing scientific literature and psychological theories that emphasize the role of stress and environmental conditions in influencing worker performance and safety, Research by various scholars has highlighted how burnout, anxiety, and depression can increase the likelihood of errors leading to accidents. Additionally, physical factors, including poor working conditions, inadequate safety measures, and a lack of proper training, have been found to exacerbate occupational hazards.

Despite the availability of safety regulations and training programs, the rate of occupational accidents remains high, particularly in high-risk industries such as Phosphate Mining. The primary problem this study addresses is lack of awareness regarding the latent psychological and physical causes contributing to these incidents, by focusing on often-unmentioned underlying factors—such as psychological distress, fatigue, and unsafe working conditions, This research seeks to uncover these hidden causes and how they can be effectively addressed within the workforce. This has led to the main research question: Are there latent psychological and physical causes for occupational accidents and proneness to them at the phosphate mining complex in Bir El Ater?

From this, the following sub-questions emerged:

- Is there a statistically significant effect of psychological difficulties faced by workers in their job positions at the Tébessa phosphate mining complex on the increased probability of their involvement in or proneness to occupational accidents?
- Does poor adherence to occupational protection and prevention measures, by both the institution and the workers, contribute significantly to the high rate of proneness to occupational accidents within the phosphate mining complex?
- Do unfavorable physical working conditions (such as excessive heat, dense dust, continuous noise, extreme cold, and rain in the quarry) have a statistically significant

effect on making workers more susceptible and prone to occupational accidents at the phosphate mining complex?

2-Study Hypotheses:

H1: There is a statistically significant effect of psychological difficulties faced by workers in their job positions at the Tébessa phosphate mining complex on the increased probability of their involvement in or proneness to occupational accidents.

H2: Poor adherence to occupational protection and prevention measures, by both the institution and the workers, contributes significantly to the high rate of proneness to occupational accidents within the phosphate mining complex.

H3: Unfavorable physical working conditions (such as excessive heat, dense dust, continuous noise, extreme cold, and rain in the quarry) have a statistically significant effect on making workers more susceptible and prone to occupational accidents at the phosphate mining complex.

3-Study Objectives:

- To measure the level of psychological difficulties faced by workers in their job positions and the extent of their correlation with involvement in or proneness to occupational accidents.
- To measure the level of adherence to occupational protection and prevention measures among workers and to clarify its relationship with the rate of occupational accidents and proneness.
- To describe the prevailing physical conditions in the work environment (heat, dust, noise, cold, rain, etc.) and analyze their contribution to increasing the probability of occupational accidents.
- To provide a set of practical recommendations for decision-makers in the institution to improve safety conditions and reduce occupational accidents and proneness to them.

4- Operational Definitions of Concepts:

4.1- Accident: An undesirable event that occurs without expectation, which may result in injury (minor or severe) or damage to objects, or may not result in anything at all.

4.2- Accident Proneness: A predisposition based on a set of personal traits and characteristics that makes an individual more likely to be involved in accidents, resulting in their accident rate being consistently higher than that of others working under the same conditions.

4.3- Accident-Prone Individual: A person who is involved in a few accidents equal to or greater than the upper quartile of the accident distribution within the group they work with.

5- Study Methodology and Tools:

5.1- Research Design: The researcher employed a descriptive-analytical method, through which the phenomenon under investigation is described, its data analyzed, and the relationships between its components, the opinions surrounding it, the processes it involves, and its effects are clarified.

5.2- Research Population: The population consists of all workers at the Djebel Onk Phosphate Complex, totaling 1,141 employees distributed across socio-professional categories (senior managers, managers, supervisors, and operators). The supervisor and operator categories dominate, accounting for over 90% of the total workforce, due to the nature of mining work.

5.3- Research Sample: The study sample was selected using a purposive sampling method. Since the study aims to investigate the latent psychological and physical causes of occupational accidents and proneness, this sampling procedure is standard in scientific research, The research sample consisted of 60 workers with whom the researcher conducted interviews.

5.4- Data Collection Tools:

5.4.1- Semi-Structured Guided Interview: An interview guide was prepared that included questions about:

- Psychological and physical difficulties faced by workers in their job positions.
- The extent of adherence to occupational protection and prevention measures, and the reasons for compliance or non-compliance.
- Prévalions physique conditions (Heat, dust, noise, cold, rain, etc.).
- The interview questions were designed to allow for the classification of responses into specific, numerically codable categories for subsequent statistical analysis.

5.4.2- Supplementary Questionnaire: A questionnaire was used to measure certain aspects of accident proneness and related behaviors.

-Instrument Validity: The validity of the questionnaire is a necessary condition for its application. The researcher relied on two types of validity to assess the instrument:

-Content Validity (Face Validity): This was based on the general appearance of the questionnaire, including the type and phrasing of items and their clarity. The instrument was presented to a group of academic researchers to judge the ability of the items to measure what they were intended to. Modifications were made based on the reviewers' suggestions.

-Internal Consistency (Construct Validity): The questionnaire was distributed to a pilot sample of (10) workers to determine its internal consistency.

-Instrument Reliability: The reliability of the questionnaire was estimated using the internal consistency method, specifically Cronbach's Alpha. As shown in Table 1, the reliability coefficients were high. The overall reliability coefficient for the study was 0.70, which is an acceptable coefficient for social studies, indicating the reliability of the current study.

Table 1 : Cronbach's Alpha Reliability Coefficient

RELIABILITY COEFFICIENT	NUMBER OF ITEMS	STUDY DIMENSIONS
Instrument Reliability	15	**0.70**

Source: Prepared by the researcher based on SPSS output.

5.5- Institution's Occupational Accident Records:

Official records of work accidents at the complex were consulted to support the data obtained from interviews and the questionnaire, and to clarify the context of the recurrence of certain accidents.

6- Data Analysis Methods:

Interview responses were coded and classified into frequency tables, and then percentages were calculated for each category.

-Tables and pie charts were used to present:

-Difficulties faced by workers in their job positions.

-The extent of adherence to protection and prevention measures.

-Prevailing physical conditions.

-The results were directly linked to the three study hypotheses to verify their empirical support.

7- Theoretical Framework of Study Variables

7.1- Definition of Work Accidents:

-Mohamed Shehata Rabie's Definition: "Anything that happens without being expected, resulting in harm to the individual or others" (Mohamed Shehata, 2007, p. 272).

-Wisely's Definition: A failure that does not meet the apparent or implicit expectation of safety during work.

-According to Eric Vatteville: An accident is an unexpected or unplanned event, sometimes resulting from the worker's location, which causes physical harm that may lead to death.

7.2- Accident Proneness: Defined by Gray as a state where individuals may be "born that way" if they are always prone to accidents. Others are prone at certain times and not at others, depending on the circumstances; these are "prone by circumstance" (Louis Lemmo & Jean Juttard, 1981, p. 90).

7.3- Causes of Work Accidents: There are numerous causes leading to work accidents, which can be classified globally. Among the common classifications are:

7.3.1- Personal Causes:

-Intelligence: The link between intelligence and accidents was evident in one study where it was found that workers who had taken intelligence tests at the beginning of their employment and scored highly were the least likely to be injured in work accidents.

-Experience: Research on the relationship between length of work experience and accidents has shown a general trend of decreasing accident rates with longer experience (Hamdi Yassin, 2010, p. 195).

-**Motivation**: As motivation is the driving force of an individual's behavior, their productivity varies with their level of motivation. A lack of motivation in a worker can lead to involvement in accidents (Farag Abdel Kader Taha, 2017, p. 404).

7.3.2- Physical Causes:

-Temperature: Research has shown that the temperature at which an individual works affects the number of accidents and resulting injuries. It was found that work injuries are at their minimum when individuals work at a moderate temperature. As the temperature deviates from the optimum, either by decreasing or increasing, the rate of work accidents increases (Salah Al-Shinwani, 2019, p. 129).

-Noise: Its effects are seen in rapid fatigue, nervous tension, and a lack of desire to work. For example, continuous machine vibration can lead to arterial constriction and

atrophy of hand muscles, and in some cases, may cause occupational paralysis (Abdel Fattah Mohamed Dweidar, 2000, p. 350).

- Lighting: Good lighting is not about concentrating the maximum amount of light on a specific area but rather providing a specific area with the appropriate amount and distribution of light. Proper distribution means ensuring light is spread so that there are no dark or shadowed areas and others that are excessively bright, as this causes eye strain due to the need for constant adaptation to different light levels (Salah Al-Shinwani, 2019, p. 208).

-Ventilation: This refers to changing and renewing the air during work, which helps remove unpleasant and harmful odors. Poor ventilation can lead to lethargy and fatigue, which may result in inadequate responses and unsafe behavior, thereby increasing the risk of accidents (Mohamed Shehata, 2007, p. 277).

8. Presentation and Discussion of Results considering the Study Hypotheses

8.1- Presentation and Discussion of Results

Table 2: Difficulties Faced by Workers in Their Job Positions

	DIFFICULTES FACE BY WORKS	FREQUENCES (H)	PERCENTAGE (%)
1	The task requires high precision and concentration	4	**16%**
2	The task requires significant muscular effort	8	**32%**
3	The task requires patience and long duration	2	**8%**
4	The task requires caution and psychological readiness	4	**16%**
5	Anxiety, routine, and idleness at work	7	**28%**
	Total	**25**	**100%**

Source: Prepared by the researcher based on SPSS output.

Table 2 shows that tasks requiring significant muscular effort were the most frequently cited difficulty (32%), particularly in the quarry department where large quantities of raw phosphate are handled. This was followed by anxiety, routine, and idleness (28%). The need for high precision and concentration (16%) and the requirement for caution and psychological readiness (16%) was also significant, highlighting the mental and physical demands of the work. Workers noted that mental lapses or psychological disengagement could lead to serious accidents like falls or stumbles. The need for patience for tasks of long duration was mentioned by 8% of respondents.

Table 3: Workers' Adherence to Occupational Protection and Prevention Measures

	ADHERENCE TO PROTECTION AND PREVENTION MEASURES	FREQUENCES (H)	PERCENTAGE (%)
1	Safety and prevention equipment is insufficient	1	**6%**
2	Inadequate and does not protect from cold in winter	1	**6%**
3	Inadequate and does not protect from heat in summer	1	**7%**
4	Causes psychological anxiety for the worker when worn	5	**31%**
5	The worker is not prepared to wear or adhere to it	8	**50%**
	Total	16	**%100**

Source: Prepared by the researcher based on SPSS

The data in Table 3 reveal significant issues with adherence to safety measures. The majority (50%) indicated that workers are "not prepared to wear or adhere to" personal protective equipment (PPE). A significant portion (31%) reported that wearing PPE causes psychological anxiety, Workers justified not wearing the complex's official attire by stating it is inadequate for extreme weather, with 6% and 7% respectively noting it fails to protect against severe cold in winter or heat in summer, This leads to fatigue and psychological distress, increasing their proneness to accidents. The lack of adherence is attributed to a weak safety culture, insufficient enforcement by industrial security, and a desire to avoid organizational conflict.

Table 4: Physical Working Conditions and Their Impact on Workers

	PHYSICAL WORKING CONDITIONS	FREQUENCES (H)	PERCENTAGE (%)
1	Heat	7	**18%**
2	Dust	13	**34%**
3	Continuous noise and clamor	6	**15%**
4	Inadéquate cold in Winter	9	**23.10%**
5	Heavy rain in the quarry sector	3	**7.90%**
	Total	38	**%100**

Source: Prepared by the researcher based on SPSS output.

Table 4 illustrates that physical and environmental factors play a crucial role. Dust from blasting operations was the most cited issue (34%), leading to occupational diseases like allergies and respiratory distress. Extreme cold in winter (23.10%) and intense heat in summer (18%) were also major concerns, reflecting the region's climate. Continuous noise from machinery (15%) impairs communication and hearing, increasing the risk of accidents. Heavy rains (7.90%) create slippery conditions, especially when workers do not wear appropriate footwear, making them prone to falls and accidents.

8.2- Discussion of Results considering the Hypotheses:

8.2.1- Difficulties Faced by Workers Across Different Job Natures:

The first hypothesis (H1) stated that psychological difficulties contribute to an increased probability of accidents. The results showed high percentages of difficulties related to muscular effort, anxiety, routine, and the need for precision and concentration. These are all factors that enhance physical and mental fatigue, reducing alertness and attention, thereby increasing the likelihood of errors and negligence. Worker narratives (especially from night shifts or routine jobs) supported this with complaints of boredom, pressure, and lack of sleep. Thus, the field results are consistent with literature highlighting the impact of fatigue, anxiety, and psychological stress on increasing accidents, which supports the first hypothesis.

8.2.2- Prevention and Industrial Safety Measures:

The second hypothesis (H2) proposed that poor adherence to protection and prevention measures is a major cause of accident proneness. The results reveal that approximately half of the responses indicate workers are not prepared to wear PPE, and nearly a third find it causes anxiety and discomfort. Some workers also view the equipment as insufficient or thermally inadequate. This situation reflects a weak safety culture, a lack of continuous training, and the absence of strict supervision by industrial security. In such conditions, the worker is directly exposed to risks without effective protection, and recurrent accidents become a form of objective "proneness," whether the worker is conscious of it or not, thus supporting the second hypothesis.

8.2.3- Physical Conditions:

The third hypothesis (H3) assumed that unfavorable physical conditions (heat, dust, noise, cold, rain) make workers constantly prone to occupational accidents. The results showed that dust, cold, and heat were the most frequently cited complaints, in addition to noise and rain. These elements affect the physical and psychological health of the worker: dust causes respiratory problems and allergies; noise impairs hearing and communication; heat and cold lead to fatigue and exhaustion; and rain increases the risk of slipping. When these conditions are combined in an open-pit mining environment, with inadequate adaptation of protective equipment, the worker is placed in a state of constant threat, which supports the third hypothesis.

Conclusion:

Based on the literature reviewed and the data collected from the field, this study has shown that occupational accidents and proneness to them at the Djebel Onk Phosphate Complex are not merely the result of isolated individual errors or technical failures. Rather, they are the outcome of a complex interaction between:

- ✓ Psychological and physical difficulties in the job (anxiety, routine, fatigue, mental lapses, significant muscular effort).
- ✓ Poor adherence to protection and prevention measures, for reasons related to their suitability, comfort, and the prevailing safety culture.

- ✓ Harsh physical conditions (dust, heat, cold, noise, rain) that affect health, performance, and attention.

Thus, the three hypotheses have received empirical support through the quantitative analysis of interview content and accident records.

Based on the findings, several issues have been identified that can be overcome and controlled. Therefore, the following recommendations are proposed based on the study's results:

- Conduct further studies and research to identify the causes, especially psychological ones, that lead workers to have accidents.
- Organize training sessions and courses for workers prone to occupational accidents to enrich their existing skills.
- Improve physical working conditions, such as lighting, and reduce continuous noise and clamor.
- Enforce strict adherence to protection and safety measures and assign safety committees to oversee worker comfort and protection from accidents and proneness.
- The institution must fully address workers' concerns, both materially and morally, to retain its human resources and maintain its competitiveness among other institutions.
- Involve workers in discussing work problems and finding effective solutions.

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