Volume 4, Issue 3, 2021 ISSN: 2617-4596
DOI: https://doi.org/10.31058/j.mana.2021.43002

Providing Health, Safety and Environmental Management (HSE) program in Metal Mining Industry (Including Case study)

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Received: 23 December 2020**; Accepted:** 25 March 2021**; Published:** 17 June 2021

Abstract:

Today, it is no longer a secret that one of the most important parts of managing an organization and that an organization wants to be successful and competitive in competition with other organizations is to rely on integrated management methods. These methods, which include a combination of different managements, look at the organization as an integrated system and try to manage all its needs, activities, products, waste and waste materials. The Integrated Management System (IMS) addresses three categories of safety, quality and environment in the framework of international standards 9001ISO (quality management), 14001 ISO (environmental management) and 18001OHSAS (safety management). The relevant research deals with health, safety and environmental management. The method of this research is descriptive and analytical and to conduct it, the research tool "Questionnaire" was used and the study area was Calcimin Company - Dandy Lead and Zinc Concentration Complex. In prioritizing the units to make corrective suggestions, first the risks that have a higher residual risk number were prioritized. Also, among the units, those units that have the highest number of critical, unacceptable and border risks were ranked, respectively. The results showed that the control room unit with 15 hazards is in the first priority to make safety corrections and reduce the risk related to the hazards identified in this unit.

Keywords:

Health Management, Safety, Health Environment, Metal Mining Industry

1. Introduction

The introduction of your article is organized as a funnel that begins with a definition of why the experiment is being performed and ends with a specific statement of your research approach. And it highlights controversial and diverging hypotheses when necessary.

Tendency to safety as an essential need is one of the most obvious and logical organizational principles, and if the safety system is fully established, along with sufficient attention of senior organizational managers, it has great benefits that accident prevention will be one of its achievements.

Having a life free from danger has been the dream and goal of all people in all ages, because the desire for safety and security is an inseparable part of the nature of all human beings. On the other hand, human beings have always been trying to improve their lives and more comfort, and in this way, they have tried to make changes in nature, to use its variables, which in this way, along with access to materials, equipment, devices and In other words, it is easier to employ new technology, etc., as well as more risks and also newer.

Today, it is no longer a secret that one of the most important parts of managing an organization and that an organization wants to be successful and competitive in competition with other organizations is to rely on integrated management methods. These methods, which include a combination of different managements, look at the organization as an integrated system and try to manage all its needs, activities, products, waste and waste materials. The Integrated Management System (IMS) addresses three categories of safety, quality and environment in the framework of international standards 9001ISO (quality management), 14001 ISO (environmental management) and 18001OHSAS (safety management).

Man is responsible to God, himself and society, and the promotion of health is the responsibility of all members of society. Hence, effective views, Islamic programs on lifestyle and its various dimensions, efforts to empower individuals, increase individual and group capacity, increase sense of responsibility, popular participation, active presence of various sectors in development, strengthening personal relationships and Social, public policy with a health approach can be used to develop social capital, community health and environmental protection.

2. A Review of Research History

Abdi Hevelayi et al. [1], studied Predicting Entrepreneurial Marketing through Strategic Planning (Including Case Study).

Haj Abukahaki et al.[2], studied Identification and prioritization of effective indicators on optimal implementation of customer relationship management in the insurance industry(including case study).

Taghipour et al.[3], studied Risk analysis in the management of urban construction projects from the perspective of the employer and the contractor.

Rezvani Befrouei MA et al.[4], discussed Identification and Management of Risks in Construction Projects.

Alamdar khoolaki et al.[5], studied Effect of integrated marketing communication on brand value with the role of agency's reputation .

Taghipour et al. [6], studied Analyzing the Effects of Physical Conditions of the Workplace on Employees Productivity.

Baghipour sarami et al.[7], studied Modeling of Nurses' shift Work schedules According to Ergonomics: A case study in Imam sajjad (As) Hospital of Ramsar.

Taghipour et al. [8], studied Supply Chain Performance Evaluation in IN The IT Industry.

Taghipour et al.[9], studied the Study of the Application of Risk Management in the operation and Maintenance of Power Plant Projects

Mahboobi et al. [10], discussed Assessing Ergonomic Risk Factors Using Combined Data Envelopment Analysis and Conventional Methods for an Auto Parts Manufacturer. occupational injuries are currently a major contributor to job loss around the world.

Taghipour et al. [11], studied Assessment and Analysis of Risk Associated with the Implementation of Enterprise Resource Planning (ERP) Project Using FMEA Technique.

Taghipour et al. [12], studied Construction projects risk management by risk allocation approach using PMBOK standard.

Taghipour et al. [13], studied The Evaluation of the Relationship between Occupational Accidents and Usage of Personal Protective Equipment in an Auto Making Unit.

Taghipour et al. [14], studied Necessity Analysis and Optimization of Implementing Projects with The Integration Approach of Risk Management and Value Engineering.

Taghipour et al. [15], studied Evaluating Project Planning and Control System in Multi-Project Organizations under Fuzzy Data Approach Considering Resource Constraints.

Taghipour et al. [16], studied Implementation of Software-Efficient DES Algorithm.

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Taghipour et al.[18], studied the impact of ICT on knowledge sharing obstacles in knowledge management process.

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Khalilpour et al. [21], studied The Impact of Accountants Ethical Approaches on the Disclosure Quality of Corporate Social Responsibility Information an Islamic in Iran.

Taghipour et al. [22], studied Identification and Modeling of Radio Wave Propagation Channel in Industrial Environments.

Taghipour et al. [23], studied Evaluating CCPM method versus CPM in multiple petrochemical projects.

Soleymanpour et al. [24], studied Mathematical modeling for the location-allocation problem allocation of mobile operator subscribers' affairs' agencies under uncertainty conditions.

Taghipour et al. [25], studied Application of Cloud Computing in System Management in Order to Control the Process.

Taghipour et al.[26], studied Evaluation of Tourist Attractions in Borujerd County with Emphasis on Development of New Markets by Using Topsis Model.

Abdollahzadeh & Taghipour [27], studied Identify and Priories Suitable Area for Ecotourism Development using Multi-Criteria Analysis for Development of the Tourism Market in Iran (Nathanz City).

Mirzaie et al.[28], studied The Relationship Between Social Bearing Capacities with Conflict as a Result, in the Perception of the Visiting Historical Sites.

Abdi et al. [29], studied the relationship between strategic planning with entrepreneurial marketing in the saderat bank of north tehran.

Abbasi & Taghipour,[30], studied An Ant Colony Algorithm for Solving Bi-Criteria Network Flow Problems in Dynamic Networks.

Sedaghatmanesh & Taghipour [31], studied Reduction of Losses and Capacity Release of Distribution System by Distributed Production Systems of Combined Heat and Power by Graph Methods.

Taghipour et al. [32], studied A Survey of BPL Technology and Feasibility of Its Application in Iran (Gilan Province).

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Taghipour et al. [43], studied The Impact of Working Capital Management on the Performance of Firms Listed in Tehran Stock Exchange (TSE).

Habibie Machiani et al. [44], studied The relationship between social responsibility and brand of companies listed on the Tehran stock exchange.

Asadifard et al.[45], studied A Multi-Objective Mathematical Model for Vehicle Routing Problem Considering the Time Window and Economic and Environmental Objectives Using the Metaheuristic Algorithm Based on Pareto Archive.

Taghipour and Azarian. [46], studied The Impact of Extensive Quality Management on Human Relations (Case Study: Education).

Taghipour and Vaezi. [47], studied Safe Power Outlet.

Taghvaee yazdi et al. [48], studied The Impact of Intellectual Capital on Organizational Entrepreneurship (Case Study: Mazandaran Science and Technology Park)

Azarian and Taghipour. [49], studied The Impact of Implementing Inclusive Quality Management on Organizational Trust (Case Study: Education).

Azarian et al. [50], studied The Effect of Implementing Total Quality Management on Job Satisfaction (Including Case-Study)

Ghadamzan Jalali et al. [51], studied Explain the Relationship Between Intellectual Capital, Organizational Learning and Employee Performance of Parsian Bank Branches in Gilan province.

Tarverdizadeh et al. [52], studied Predicting students' academic achievement based on emotional intelligence, personality and demographic characteristics, attitudes toward education and career prospects through the mediation of academic resilience.

Taghvaee yazdi et al. [53], studied The Relationship between Implementation Principles of Implementation with Organizational Accelerations, Ethical Leadership and Empowerment of Managers (Case study: Employees of national banks in Sari, District 1)

Habibie Machiyani et al. [54], studied Using Business Intelligence to Provide a Model for Smartening the Management of Iranian Chain Stores.

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Arsalani et al. [57], studied Investigating the Effect of Social Media Marketing Activities on Brand Awareness.

Mohammadi et al. [58], studied Investigating the role and impact of using ICT tools on evaluating the performance of service organizations.

Changiz Delivand et al. [59], studied Investigating the effective factors in measuring customers' credibility with a combined approach of data mining and multidisciplinary decision making.

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3. Statement of the Problem

Mining has a long history of importance as one of the important sub-sectors of the industrial sector and as a supplier of raw materials needed by industry. Mining activities also have a long history; The relatively traditional way of mining activities has always been associated with hazards for workers in the workplace. According to published statistics, a significant proportion of deaths due to accidents are related to work accidents, among which mining activities have a higher figure due to the type of work and work environment, as well as very little attention to safety. In addition to paying attention to the issue of safety in mining activities, much attention should be paid to the environment as a platform for development in today's world, because the most important human activities are performed in this context. Mining activities are considered as a very important factor in environmental degradation. Various pollutants such as dust, water pollution and soil pollution due to insufficient attention to the environment in these activities are considered. Therefore, it is felt that in the mining activities of the country, which of course includes a significant amount of labor and the environment, safety as a risk mitigator from mining activities, health as a provider of health status of the workforce involved in the mine and the environment to The title of the platform of activities is ignored and there is practically no suitable procedure for safety, health and environmental management (HSE) in mining activities in the country.

3.1. Necessity of Research

Due to the underlying problem of mining activities as a supplier of raw materials (raw materials) of the country's industries and due to the lack of proper safety, health and environment (HSE) procedures and HSE management in general in these activities the level of labor productivity The work of the tools used is very low and also due to the lack of attention to the environment and its increasing degradation through mining activities (exploration to processing) and various pollutants that are imposed on the environment, the need to establish a proper safety procedure and management. , There is health and environment (HSE) to minimize the losses caused by work accidents and on the other hand, by applying proper environmental management, the amount of pollutants entering it through mining activities is minimized and the existing pollution is eliminated.

3.2. An Overview of the Research

Hosseini, in a study, evaluated the environmental effects of Mehdiabad lead and zinc mine using two methods: Leopold matrix and fast matrix and compared these two methods by comparing their results; He points out in this study that the results of the Leopold matrix are mostly around negative or positive effects at a low level, and the results of the rapid matrix show more dispersion and also show very positive effects; As a result, the rapid matrix can be used as a background to determine the effects of the mining project on the environment [61]. Jalalmanesh, in another study has evaluated the environmental effects of mining activities in the Mayqan desert; In this research, he has studied the infrastructure (accesses, power (water), energy, etc.), the production stages of sodium sulfate powder, etc., and by forming an environmental impact assessment matrix, he has finally approved the project by presenting

improvement plans [62]. . In a study, Shukri evaluated and analyzed the risk in tunnel construction based on the FMEA method and the purpose of the study was to identify the risks of tunnel construction projects and classify them based on their probability and severity. Having chosen the third line of Tehran Metro as his case study, he presents a tunnel risk management algorithm [63].

3.3. Research Goal

Due to the infrastructural issue of activities and mining industries as suppliers of raw materials (raw materials) of the country's industries and due to the lack of proper safety, health and environment (HSE) procedures and HSE management in general in these activities The labor force and tools used are very low and also due to lack of attention to the environment and its increasing degradation through mining activities (exploration to processing) and various pollutants that are imposed on the environment, the need to establish a procedure and There is proper management of safety, health and environment (HSE) to minimize the losses caused by accidents at work, and on the other hand, with proper environmental management, the amount of pollutants entering the environment through the mining industry is minimized and existing pollution. To be eliminated.

3.4. Research Hypothesis

The research hypothesis is based on the fact that in practice there is no appropriate and purposeful and disciplinary procedure in relation to safety, health and environmental management (HSE) in the country's mining industry. And is unacceptable.

3.5. Research questions

Are the hazards of the mining industry known and classified for the labor force involved?

Have the threatening and destructive factors of the environment caused by the mining industry been identified and classified?

Is there a safety, health and environment (HSE) management practice in place for the mining industry?

3.6. Research Methods

The method of this research is descriptive and analytical and to conduct it, the research tool "Questionnaire" has been used and the study area is Calcimin Company - Dandy Lead and Zinc Concentration Complex.

OHSAS18001 standard:

Organizations of all kinds are increasingly interested in achieving and proving the explicit performance of their occupational safety and health by controlling occupational safety and health risks according to their occupational safety and health policies and objectives. They do so in the form of increasingly stringent laws, economic policies, and other measures to address best practices in occupational safety and health, and to increase stakeholder attention to occupational safety and health issues. (Standard text OHSAS18001, 2007).

Benefits of establishing an occupational safety and health system:

1- Planned and documented attitude, 2- Defining responsibilities, 3- Increasing awareness and raising competencies, 4- Securing the work environment and reducing risks, 5- Reducing the risk of accidents and diseases caused by work, 6- Creating motivation and Job security among personnel and as a result increase productivity that will lead to production, 7- Reducing downtime due to illness and injuries caused by accidents, 8- Reducing costs due to damages caused by accidents [64].

Overview of risk analysis techniques:

These techniques are special methods of risk analysis that, due to their nature, offer unique methods of risk analysis. So far, more than 100 different risk analysis techniques have been identified and used that the appropriate method is selected based on the needs or requirements and conditions ahead [65].

The most important of these techniques are:

Preliminary Risk Analysis (P.H.A):

Preliminary risk analysis is a system safety analysis method that is used to assess and document the risk of new or modified systems. It is the analysis and evaluation of the general risk group in the system and provides recommendations and suggestions in to control them. Preliminary risk analysis is usually the first attempt in the system safety analysis process to identify and classify potential hazards associated with the operation of a system, process or procedure.

Man is responsible to God, himself and society, and the promotion of health is the responsibility of all members of society. Hence, effective views, Islamic programs on lifestyle and its various dimensions, efforts to empower individuals, increase individual and group capacity, increase sense of responsibility, popular participation, active presence of various sectors in development, strengthening personal relationships and Social, public policy with a health approach can be used to develop social capital, community health and environmental protection.

Preparation of Preliminary Risk List (s) (P.H.L):

These lists are prepared and produced at the beginning and at the opening of the risk analysis project and are designed to meet all the analytical information requirements of the hazard and what is defective from a system safety perspective and may cause an accident. Meet. Hazardous materials, unsafe designs, defective or hazardous machinery and equipment, hazardous environmental conditions, hazardous behaviors and situations, and the like should be carefully listed on these lists. The more complete and detailed the information in these lists, the more effective the various processes of preparing control options or preventive measures will be.

Operations and Support Risk Analysis (O & SHA):

Operational and Support Risk Analysis is a system safety analysis technique that focuses primarily on related or man-made hazards or tasks involved in operating the system. This technique may also be referred to as "Operational Hazard Analysis = OHA". To be read.

Failure Risk Analysis (F.H.A):

Failure risk analysis is an inductive or deductive method for risk analysis in work systems that can be used specifically for a qualitative analysis and if necessary also developed as a quantitative analysis. Failure risk analysis requires the study of

subsystems or in other words subsystems to determine the various hazards, their causes and effects on system components and their operations.

Error Tree Analysis (F.T.A):

Error analysis technique or cause tree method is considered as one of the most powerful tools for system safety process analysis, especially when evaluating very complex and accurate systems. Due to the use of deductive method (reaching from whole to part) In this method, many system safety analysts consider the use of FTA method to be very useful in investigating various situations that can lead to favorable or undesirable events at the system level [66].

Failure mode and impact analysis (FM&EA):

FM&EA, one of the most well-known systems safety analysis techniques today, was first established in the late 1950s by reliability engineers to assess the safety of military systems. The use of this method then expanded rapidly to be used in the United States and France to assess the safety of Concorde and Airbus aircraft, respectively; Following the accident, the application of this technique to the safety assessment of the nuclear industry was also developed. This technique, which is essentially a qualitative analysis, examines the system or subsystems to identify possible defects in all its components and attempts to assess the effects of possible defects on other parts of the system. Although FM&EA needs to be performed in the early stages of product life, especially in the design phase, based on available data, if needed, the system safety analyzer can use this tool to identify and evaluate component defects throughout the life of the product or system. Slow [67].

Operations and Risk Study (HAZOP):

The word HAZOP is derived from the first three letters of the word Hazard meaning danger and two Primary operability means operation capability [68].

This technique is a legal method of identifying process hazards and determining their effects on the system. This technique, which is often used in the chemical industry and in the case of heating-hydraulic systems, is based on the principle that: "The system is safe when All its operational parameters such as temperature, pressure, viscosity, acidity, etc. are in a normal and acceptable state ".

Occupational Safety Analysis (J.S.A):

One of the common causes or perhaps the primary cause of workplace accidents is the mismatch between employees (workers) and their jobs. The existence of any inconsistency between the characteristics of individuals and occupations can lead to fatal accidents or chronic occupational diseases, so adequate measures must be taken to establish this conformity. Applying a branch of safety knowledge called Occupational Safety Analysis (JSA) can be done by creating field and theoretical studies and determining the requirements of each job and then determining the appropriate indicators for the performance of these jobs, creating maximum compliance between jobs. And individuals eliminated, reduced or controlled the unfavorable risk factors resulting from this issue.

Health Risk Assessment (H.H.A):

The H.H.A technique is used to assess these hazards and the information obtained is used for forecasting in system designs. In addition to the application of the H.H.A technique in the design phase, it should also be used in all stages of the system life

cycle. This technique is focused on identifying occupational health factors and then suggests appropriate criteria to eliminate these risks, reduce them to the permissible level or control them by applying engineering or managerial controls.

ISO14001 standard:

ISO14001 is developed by ISO / TC 207 Technical Committee "Environmental Management", SC1 Subcommittee "Environmental Management Systems". This International Standard sets out the requirements for an environmental management system so that an organization can establish and implement its policies and objectives, taking into account legal requirements and information on obvious environmental aspects, and in all organizations. It can be used in any type and size and includes various geographical, cultural and social conditions. Such a system enables the organization to develop policies, create macro-environmental goals and processes to meet environmental commitments, take action to improve its performance, and demonstrate that the system complies with the requirements of this International Standard. The overall purpose of this International Standard is to support environmental protection and pollution prevention so that it is in balance with socio-economic needs (text of ISO14001: 2004).

Risk assessment method and implementation steps:

In this study, the H.H.A (Health Risk Assessment) method was used to assess the risk. The reason for using this method is that because in OHSAS standard, the risk feedback from activities is ultimately human, so using this method, the risks affecting human activities and health have been identified.

The method of work at this stage was to hold several meetings with the managers of the complex and the relevant officials. In the next stage, for a more detailed study, the whole complex was divided into 24 study units. In each unit, major and important activities were identified and then by distributing the identification sheets of risks and hazards and instructions for completing them among the officials of the units with the participation of unit managers, the risks and hazards were identified.

In the next step, the information obtained from the previous step was transferred to special forms for risk assessment and after calculating the risk number, corrective solutions were provided.

In order to identify and assess the risk of environmental aspects, after attending various units, the aspects were identified directly and in some cases with the help of the relevant authorities. Finally, by transferring the data obtained from this stage, the forms related to risk assessment of environmental aspects were completed and the relevant risk level was estimated, and finally, it resulted in providing corrective solutions and recalculating the risk level.

3.7. Risk Number Calculation (RPN)

After finding the number of accidents for the risk year, Katesari and Zarodi [69] predicted the number of accident for the next year through dependency risk modeling and copula. This is while that copula tool is used to detecting risk of asymmetric information in collision insurance industry in the work of Katesari and Vajargah [70]. Similarly, to calculate the risk number, multiplication of three components of accident probability, severity of consequences and probability of tracking is used as follows:

a- Probability of occurrence of an accident: The probability of occurrence determines the frequency with which a cause or mechanism of danger occurs; To express this component, the numerical value of 1 (probability of accident or defect seems unlikely) to 10 (occurrence of accident is very, very probable) is used as follows:

Table 1. *Probability of accident.*

numerical value	Descriptive phrase
10	An accident or defect is very, very likely (once a day or more)
9	Accident or defect is very likely (every 3 to 4 days)
8	The probability of an accident or defect is very high (once a week)
7	The probability of an accident or defect is high (once a month)
6	The probability of an accident or defect is moderate (once every 3 months)
5	The probability of an accident or defect is low (once every 6 months to a year)
4	The probability of an accident or defect is very low (once a year)
3	Accident or defect is rare (every one to three years)
2	The possibility of an accident or defect is very rare (every 3 to 5 years)
1	The possibility of an accident or defect seems unlikely

b- Severity of consequences: The amount of damage to property (in terms of financial loss) and human (in terms of loss of life), determines the severity; To express the severity of the consequences, a numerical value of 1 (no system damage is expected) to 10 (complete system failure) is used as follows:

Table 2. *Intensity of consequences.*

numerical value	Descriptive phrase
10	Complete system failure
9	The damage to the system is severe
8	The damage to the system is enormous
7	The damage to the system is great
6	Damage to the system is moderate
5	Damage to the system is low
4	The damage to the system is very small
3	Damage to the system is minor
2	The damage to the system is very minor
1	No system damage is expected

c- Probability of detection: Probability of detection or detection of danger is a kind of assessment of the ability to identify a cause or mechanism of occurrence of danger; In other words, the probability of discovery is the ability to detect danger before it occurs; To express the probability of tracking, a numerical value of 1 (automatic tracking with alarm and control at the same time with the controller and operator system) to 10 (absence of any tracking system and absence of operator) is used as follows:

Table 3. *Probability of tracking.*

numerical value	Descriptive phrase
10	Lack of any tracking system and no operator
9	Objective and random tracking
8	Tracker objectively and periodically
7	Random tracking with measuring tools
6	Tracking with measurement tools periodically
5	Permanent tracking with measuring instruments
4	Automatic tracking with visual or audible alarms

3	Automatic tracking with visual and audible alarms
2	Automatic tracking with alarm and control system
1	Automatic tracking with alarms and simultaneous control with the controller and operator system

Table 4. *Risk Index Classification (rpn).*

Risk status	Rpn
acceptable	rpn<70
Border	rpn <8170
unacceptable	rpn <12081
Critical	rpn > 120

3.8. Risk Assessment of Environmental Aspects

In risk assessment, the environmental aspects are determined to determine the levels of risk in the following order:

a- The following table is used to calculate the severity of the accident:

***Table* 5.** *Classification of the severity of the incident according to the standardMIL-STD-88213.*

Definition	Floor	Type of danger
Mortality or system failure	1	Disastrous
Injuries, occupational diseases or injuries to the system are severe	2	Critical
Injuries, occupational diseases or injuries to the system are minor	3	Border
Injuries, occupational diseases or injuries to the system are very small	4	minor

b- The following table is used to determine the levels of risk probability :

Table 6. *Risk probacb.*

Risk description	Danger level	Probability of occurrence
It happens frequently .	A	Frequent
Occurs several times during the life of a system .	B	Probable
Occasionally occurs during system life .	C	Occasional
It is very unlikely to occur during the life of the system .	D	Very little
The probability of its occurrence during the life of the system is so low that it can be assumed to be zero .	E	Unlikely (

c- The following matrix is used to assess the risk :

Table7*. Risk assessment matrix.*

Partial (4)	Border crossings (3)	Critical (2)	Catastrophic (1)	Probability of occurrence - severity of danger
4A	3A	2A	1A	Frequent)A)
4B	3B	2B	1B	Probable)B)
4C	3C	2C	1C	Occasional)C)
4D	3D	2D	1D	Very little)D)
4E	3E	2E	1E	Unlikely)E)

Decision criteria based on risk index:

Table 8. *Decision criteria based on risk****.***

Risk classification	Risk criteria
1A, 1B, 1C, 2A, 2B, 3A	unacceptable
1D, 2C, 2D, 3B, 3C	Undesirable
1E, 2E, 3D, 3E, 4A, 4B	Acceptable but in need of revision

4C, 4D, 4E	Acceptable without the need for appeal

Risk screening:

The following table lists the maximum risks per unit .

Table 9. *List of maximum critical hazards per unit***.**

Unit Name	Type of Activity	Risk type	Risk number
Flotation	Replacement of existing electric motors on flotation cells	Trapping members between unprotected belts and gears	210
Fuel depot	Fueling machines / draining fuel from tanker to fuel tanks	Incidence of fire	162
Asia	Drug mixing in the upper floors of the pharmacy	Production of gases from drug mixing	144
Command room	Repairs and electrical service of all cranes	Falling from a height	144
Powerhouse	Boiler activity	Boiler explosion	135
Turning	Shaft turning	Stuck clothes and hands in the turning unit	126
Unit Name	Type of Activity	Risk type	Risk number
Chemical warehouse	Unloading / delivery of cargo by forklift	The load falls on the limbs	126
Repairs	Replacement of electric motor belts and production line pumps	Stuck body parts between unprotected straps	126
Rap V	Transfer of soil from crusher to sieve by conveyor	Stuck body parts between unprotected straps	126
filteration	Cleaning rollers and their lubrication and conveyor belts	Stuck body parts between unprotected straps	126
Hui Media	Transporting soil by conveyor	Stuck body parts between unprotected straps	126
Calcination furnaces	Loading soil to feed the bunker	Stuck body parts between unprotected straps	126
Calcination furnaces	Turn on the furnace burners	Incidence of fire	126
Crusher	Pour soil and rock from the top of the bunker into it	Personnel fall into the bunker	126
Filter Press	Start the conveyor	electrocution	126
Filter Press	Remove the filter press plates from the machine / drop the belt on the gearboxes	Stuck body parts between unprotected straps	126

According to the above table, it is clear that most of the risks are related to the clothes getting stuck and consequently the hands and body parts of the personnel between the belts and unprotected gears; Therefore, in order to correct this critical risk, it is necessary to install the necessary protections in all rotating parts of the devices in the integrated units in a quick and immediate action. It should be noted that most workers are reluctant to observe safety standards during work and are unaware of the protection on the rotating parts, which must be given sufficient warnings in several stages. For optimization of the estimation process, we applied the optimization method of [71].

4. Prioritization of Units to Make Corrective Suggestions

As it turns out, in the process of implementing corrective actions, the risks that have a higher residual risk number should be prioritized first. Also, among the units, those units that have the highest number of critical, unacceptable and border risks are

ranked, respectively; Therefore, it is suggested that the proposed amendments be made in the following order:

Table 10. *Prioritize integrated units to make corrective suggestions***.**

Single priority	Critical risk prioritization	Maximum critical risk	Number of cross-border hazards	Number of unacceptable risks	Number of critical hazards	Unit Name
First	Third	144	1	1	15	Command room
Second	Sixth	126	6	6	8	Calcination furnaces
Third	Seventh	126	10	5	6	Crusher
Fourth	Fourth	144	5	4	6	Asia
Fifth	Eighth	126	1	2	5	Filter Press
Sixth	First	210	0	5	3	Flotation
Seventh	ninth	126	1	1	3	filteration
Eighth	Tenth	126	7	2	2	Rap V
ninth	Eleventh	126	1	1	2	Repairs
Tenth	Second	162	2	0	2	Fuel depot
Eleventh	Twelfth	126	1	0	2	Chemical warehouse
Twelfth	Thirteenth	126	0	1	1	Turning
Thirteenth	Fifth	135	0	1	1	Powerhouse
Fourteenth	Fourteenth	126	3	0	1	Hui Media
fifteenth	------	------	0	12	0	Blacksmithing
Sixteenth	------	------	0	5	0	Technical warehouse
seventeenth	------	------	4	3	0	Product storage
Eighteenth	------	------	0	3	0	Laboratory
Single priority	Critical risk prioritization	Maximum critical risk	Number of cross-border hazards	Number of unacceptable risks	Number of critical hazards	Unit Name
nineteenth	------	------	0	1	0	Water supply
Twentieth	------	------	0	1	0	the area
twenty first	------	------	4	0	0	transport
twenty second	------	------	1	0	0	Mechanical repair shop
twenty third	------	------	0	0	0	Official

In this table, first the units of lead and zinc concentrate are classified according to the number of critical hazards. They are then classified according to the number of unacceptable hazards (rpn <120> 81) and finally according to the border hazards (70 ≤ 81 rpn≤); As can be deduced from the table above, the control room unit with 15 hazards with critical risk (<120 rpn) is in the first priority to make safety corrections and reduce the risk of hazards identified in this unit. It is also observed that there is no risk in the office unit with unacceptable risk, or in other words, all risks identified in the office unit have a risk in the acceptable range (rpn <70).

Prioritization of Dandy lead and zinc concentrate complex units to improve environmental aspects with unacceptable and undesirable risk:

Considering the risk assessment of various environmental aspects in the units of lead and zinc dandy concentrate, it is necessary to correct these aspects and reduce their risk level and to improve the environmental condition of the complex. The table below shows the prioritization of the proposed corrective actions.

Table 11. *Prioritize the integrated units to correct the aspects of the environment***.**

Priority	Number of adverse aspects	Number of unacceptable aspects	Total number of aspects	Number of activities	Unit Name
Thirteenth	5	1	26	14	Rap V
Sixteenth	1	1	6	4	Clinic
nineteenth	4	0	13	6	repair shop
twenty first	0	0	17	7	Repair of rat
Twelfth	0	2	4	2	transport
twenty third	0	0	6	3	Turning
Eighteenth	0	1	9	4	Chemical warehouse
First T.	Number of adverse aspects	Number of unacceptable aspects	Total number of aspects	Number of activities	Unit Name
First	2	10	29	7	Product storage
Tenth	1	2	11	6	Technical warehouse
Eleventh	1	2	8	5	Fuel depot
Twentieth	1	0	9	4	Command room
Fourth	4	4	29	13	Hui Media
Fifth	1	4	13	6	Powerhouse
Seventh	3	3	30	16	Calcination furnaces
twenty second	0	0	16	11	Blacksmithing
ninth	3	2	13	6	pharmacy
Fourteenth	4	1	23	9	Asia
Twenty fourth	0	0	6	4	Water supply
Second	7	6	23	10	Flotation
Eighth	3	2	38	15	Crusher
Third	3	6	29	17	Filter Press
fifteenth	1	1	7	4	Official
Sixth	4	3	19	9	filteration
seventeenth	0	1	22	15	Laboratory

According to the above table, the first priority in improving the environmental aspects and reducing the level of risk arising from them, is the product storage unit. This unit has 7 activities and 29 recognized environmental aspects. Of these, 10 are unacceptable environmental aspects and 2 are unfavorable environmental aspects, which has made this unit the first priority for taking action to improve the environmental aspects. In this unit, there is the creation of lead and zinc dust and as a result air pollution as the most important environmental aspect with an unacceptable level of risk. To correct this process, the product should be moistened as much as possible and also enclosed with a covering material. Appeared.

The water supply unit has the least impact on the environment with 6 environmental aspects, all of which have an acceptable level of risk.

5. Suggestions for Future Research

Due to the wide range of environmental harmful factors such as noise and toxic dust in the mining industry, it is recommended to conduct a quantitative study of these factors in the lead and zinc processing industry.

Considering that one of the effective parameters of mining activities on the environment is the impact of these activities on water resources, so a study is proposed to investigate the impact of lead and zinc concentrate complex activities on water resources (especially groundwater) in the region. Grapes take place.

Considering that in this study, HHA method was used to assess the risk of activities of lead and zinc dandy concentrate complex, it is suggested to use one of the other risk assessment methods to assess the risk of this complex and the results with the results of HHA method. Be compared.

Considering that one of the important factors in advancing the goals of the safety, health and environment program is the spread of H.S.E culture in an organization, so it is suggested that this research be investigated in the mining industry.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this article.

Funding

This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

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