

# Analysis of near-miss incidents (NMI) reporting in mining operations

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## Abstract

**Purpose.** In safety management, near-miss incident (NMI) reporting has been recognised as an essential practice in the prevention of mining accidents. This research aims to investigate near-miss incidents in Kosovo mining operations based on previous researches and in-situ surveys.

**Methods.** For this purpose, both qualitative and quantitative methods were used as an observation tool, with 115 questionnaires randomly assigned among the employees at mining companies. To analyse collected data, the Excel Spread-Sheet and SPSS software were used. The survey was conducted to get basic information on the number of near-miss incidents, how they occurred and were brought to the light, as well as to reveal their similarity with mining accidents that happened during mining operations in Kosovo.

**Findings.** The research brings to the light that mining activities related to production are the most predominant sources of near-miss incidents. From the qualitative observation approach in different mining companies, it has been found that the majority of mines do not report even in an informal way about near-miss incidents that the employees experience.

**Originality.** The legislative framework of Kosovo does not require a formal reporting on near-miss incidents. Therefore, the present research aims not only to develop proper legislation, but also to comprehensively study the main factors causing near-miss incidents in order to improve mining safety. Increasing the transparency of data on near-miss incidents and their publication should facilitate research work related to improving the safety of mining operations, in other words, the prevention of mining accidents.

**Practical implications.** Apart from the literature review and questionnaire survey conducted in two underground hard rock mines and one surface coal mine, owned and operated by Kosovo authorities, this research attempts to examine sources, influencing factors associated with near-miss incidents, as well as to analyse the best practices of NMI reporting in order to enhance mining safety management in mining sector.

**Keywords:** near-miss incidents, safety, influencing factors, injury, hazard

## 1. Introduction

Near-miss incident (NMI) concept has been defined in [1] as an undesired sequence of events with high potential threats that cause serious damage to mine workers and mining machinery (Fig. 1). In the work [2], it is noted that a near-miss incident is an unplanned event, and every mine accident or fatal accident is a near-miss incident that was neglected and was not prevented initially. Despite progress in reducing accidents in the mining industry, the statistics and figures present unsatisfactory [3] y health and safety situation in the mining industry. Along with the situation of near-miss incidents, the reporting is even worse with a probability not only in the mining industry, but also outside of it.

Mining industry that initiate near-miss incident reporting seeks to get “free lessons” on accident prevention in order to improve safety practice based on an incident with high potential for more serious consequences [2], [4]. A safety triangle developed by Heinrich (1931) indicates three different types of incidents (i.e., near-miss incidents, minor and major

injury), expressed as a ratio of 300:29:1, which means that for every 300 near-miss incidents, 29 minor injuries and 1 major occur [5]. Thus, it is noted that when near-miss incidents are not reported or neglected, it may result in more serious injuries. In addition, it is noted that accurate tracking of near-miss incidents and injuries can help reduce injuries on the working site. The findings show that organizations need to ensure reporting on more near-miss incidents for the purpose of improvement of overall safety environment. Tian et al. [6] provide an empirical study; they have studied the factors influencing the near-miss incident reporting in China coal mines. They concluded that reporting should be considered as safety awareness indicator; mine management should motivate workers to report about near-miss incidents; there must be a good communication between management and workers to give feedback on reports; to promote a good safety culture, a culture of no-blame is important; training is useful to identify and organize data collection during reporting; and it is recommended to simplify anonymous reporting as much as possible to avoid additional work.

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Figure 1. Understanding the concept of “near-miss incidents” (NMI) at the Trepca mine [7]

Mbuvi et al. [2] note that fatal accidents were coming from a near-miss incident that was not prevented and initially ignored by supervisors on the working sites. They have shown that the application and maintenance of a near-miss incident management system is an effective way to ensure a safe working place and safety performance. Additionally, each individual near-miss incident can present a risk indicator. The proposed model can be used by management to improve the working conditions on the site. Musasa and Jerie [8] have studied challenges related to the near-miss incident reporting in the Midlands Province of Zimbabwe. They have shown that employees were unwilling to report near-miss incident, because of the absence of training and knowledge about the importance of reporting and fear of victimization. They recommend encouraging employees to report near-miss incidents and allowing employees to freely share their insights with the intention of revealing the reasons why employees fail to report such incidents.

The national literature analyses the policy and legislation framework regarding mining safety i.e., near-miss incidents. In terms of mining policy, Kosovo has Mining Strategy. Mining safety is defined as follows: “The safety, well-being and health of the people involved in the mining sector are important responsibilities. The prevention of industrial accidents in the mining sector is the task of the mining management and the relevant inspection [9]”. In this regard, the relevant mining authorities (institutions) must provide appropriate laws and regulations in order to fulfil the objectives of the mining strategy. Despite mining policy requirements, there has been no progress in terms of mining safety legislation framework, and near-miss incidents have not been included in the relevant mining laws at all [10]. Thus, it can be concluded that the Kosovo mining industry is still lacking regulation of the mining industry in terms of near-miss incident reporting. In addition to a literature review and questionnaire survey conducted in two underground hard rock mines owned and operated by Trepca Joint Stock Company (TJSC) and one surface coal mine owned and operated by the Kosovo Energy Corporation (KEK), this research attempts to study the sources of influencing factors associated with near-miss incidents and analyse best practices of NMI reporting in order to improve mining safety management during mining operations.

2. Methods

The text below gives some generally accepted meanings of the terms used in the field of mining safety:

- 1) ACCIDENT is defined as an accident or undesirable event that results in personal injury or property damage;
- 2) INCIDENT is an unplanned, undesirable event that adversely affects the completion of a task;
- 3) NEAR-MISS INCIDENT is described as an incident in which no property is damaged and bodily injury occurred,

but in which, given a slight shift in time or position, damage and/or injury could easily have occurred;

- 4) HAZARD – an object or situation that has the potential to harm a person, the environment, or cause damage to property;
- 5) INJURY – any physical or mental injury to the body caused by exposure to a hazard;
- 6) DISSASTER – is any accident resulting in the death of five or more miners/persons (usually is associated with material loss and negative impact on the environment) [11].

Figure 2 shows the statistics of fatal mining accidents, that is, the number of fatalities per incident, major disaster-related mining accidents, and fatalities occurring between 1880 and 1960 (one incident resulted in several hundreds of victims). It is noteworthy that after this time, despite the incidents at the mines, the number of deaths has decreased. As mentioned above, mining incidents continue to be a concern and the study of accident prevention remains essential. Reducing the number of incidents, in particular the reporting on near-miss incidents is critical to improving the process of mining accident prevention.

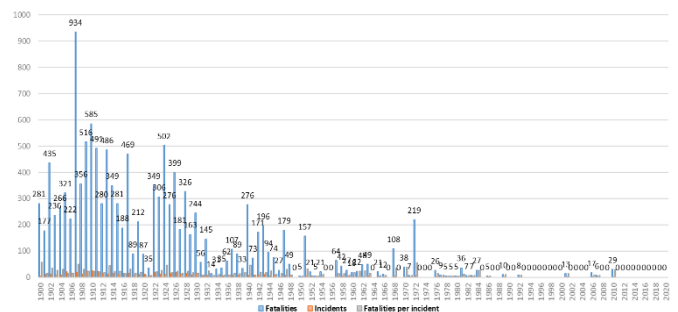


Figure 2. Mine disasters (1900-2020) [12]

Table 1 below presents the reporting on annual mining accidents [13].

Table 1. Mining accidents in Kosovo in 2019

Type of injury/company	UG/Trepca mine	KCE	Quarries	Total
Fatality	0	0	3	3
Collective injury	0	0	0	0
Major injury	5	0	1	6
Minor injury	77	6	0	83

Based on Equation 1, the incident rate for Trepca Company for 2019 is about 4.0.

This means that for every 100 employees, 6.68 employees have been a recordable injury. Based on Table 1 and Table 3 (column “A”), the accidents at Trepca can be ranked from 0.90 to 3.90, and given the time before the occurrence of danger  $t_2 = t_1 = 8$  hours ( $E' = 1$ ), according to Equation 3, the occurrence of danger is calculated as follows:

$$A = \frac{P}{E} \cdot E' = \frac{2.4}{8} \cdot 1 = 0.3 = 30\% .$$

Nevertheless, it should be emphasized that the validity of Equation 3 is based on data on accident locations, causes/agents of accidents etc., and is more reliable for certain workplaces rather than for a general hazard assessment calculation. Near-miss reporting has historically been a challenge in the mining industry [8]. Currently, the Kosovo mining industry, in addition to other mining safety issues, is also facing a failure to report near-miss incidents, thereby

creating difficulties in managing mining safety, especially in terms of accident prevention.

The methodology used in this research paper is based on a literature review, interviews with top experts in the Kosovo mining industry, and a questionnaire sent to employees of key mining companies. The first question in the questionnaire contains “was or was not involved in a near-miss incident”, followed by the core questions about the incident, namely accident reporting: year, place, hazard, potential injury etc. and whether incident was reported. The questionnaire results and interpretation are presented below.

### 2.1. Purpose of the questionnaire

The questionnaire was designed taking into account basic research information and answers to questions by recording or selecting the situation in which the employees were involved. The questionnaire includes the period from 2010 to 2020. A total of 115 questionnaires were conducted, the employees involved in this study were males, aged 24 and 50, and the population was less than 10000 [13]. Part of this interview was conducted with top mining experts from such companies as Trepca and KEK [14].

The survey was conducted between January and March 2022. According to the survey, 94 employees, or 82%, have been involved in a near-miss incident. Thus, it should be noted that some of them refused to participate in the survey and were not reflected in this number of responders. Given this, the margin error of this questionnaire could be between  $\pm 5$  to  $\pm 9\%$  [15]. Mining accidents are also associated with high costs for the operating company. There are different types of methodologies for accident cost estimation, which are based on direct and indirect costs (medical cost, work-lost-time, supervisor lost time, long social cost cover etc.). But based on NIOSH methodology of accident cost calculation, the direct cost of an injury can vary from \$500 to \$10000, while the fatal accident cost, which depends on the age and occupation of the miner, can be in excess of one million dollars [16]. Near-miss incident reporting provides the same amount of information as an accident reporting, without any serious consequences. Thus, studying the origin of the root causes of near-miss incidents will help the management system to prevent mining accidents [17]. It gives an opportunity to move from reaction to prediction of incident [1]. How to prevent an accident in the mining industry? Louis A. Allen, a leading expert and consultant in the field of management, said “Everything that exists in a certain amount and can be measured.” This includes the efforts that the management system should make to prevent accidents by improving the quality of mining accident reporting, in order to analyse the causes of mining accidents, in particular, near-miss incidents. There are three ways to measure and summarize accident causes:

- 1) measurements of results (injuries/illnesses/and other types of accident frequency rates);
- 2) measurements of causes (the immediate and underlying causes of accidents);
- 3) measurements of efforts (work done to prevent accidents and reduce harm).

Effectively measuring your safety and health programs should bring you a step closer to understanding their true nature and how to manage them. Any successful accident prevention program uses all three types of safety measurement results, causes and efforts [18].

### 3. Results and discussion

It is interesting to discuss the similar findings of the mining accident studies [3] and the present study, in particular, near-miss incident in mining activities (Fig. 3).

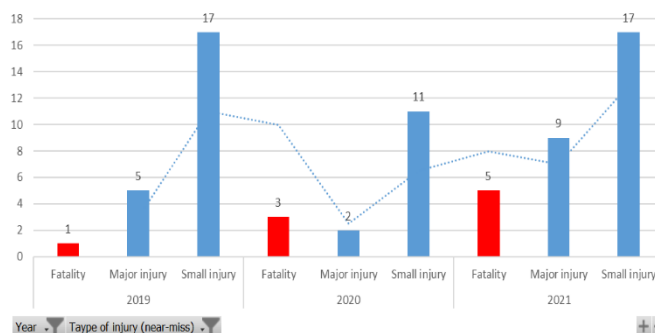


Figure 3. Near-miss incidents in the Kosovo mining industry (2019-2021)

The same agents (hazards) that caused mining accidents appear to be considered in this research paper as near-miss incidents (hits and rock-falls). On the one hand, according to both analyses, the most dangerous workplace has been identified a production site, i.e. “stope mining”, since Trepça underground hard rock mine uses the overhand cut and fill mining method with utilized post pillars [19]. Another case in which rock-fall (hit agent) is considered as one of the main hazards, and stope-mining as the most dangerous workplace, was a fatal accident at the Artana mine, which occurred due to the production gallery collapse, as a result of which two miners died under falling rocks [20]. Figures 1 and 2 show the types of injuries, agents (hazards) and workplaces where near-miss incident occurred.

Therefore, rock-falls and hit agents seem to cause fatal near-miss incidents (11<sup>th</sup>), on the production line in such a case as stope-mining. Based on a review of all fatal accidents in Queensland mines and quarries from 2000 to 2019, 9 fatal accidents are known as near-miss incidents that have occurred before the fatality. In some cases, previous deaths have occurred in a similar manner [18]. Moreover, in the Kosovo mining industry, 4 fatalities have been registered in ten years as a result of rock-falls (hit agent) associated with mining operations. It is noteworthy that the working place was stope-mining. From the figures above, it can be seen the logical relationship between accidents and near-miss incidents in terms of causes and consequences. Figure 4 shows some of the main causal factors of near-miss incidents, such as human errors, lack of training, lack of signalization etc.

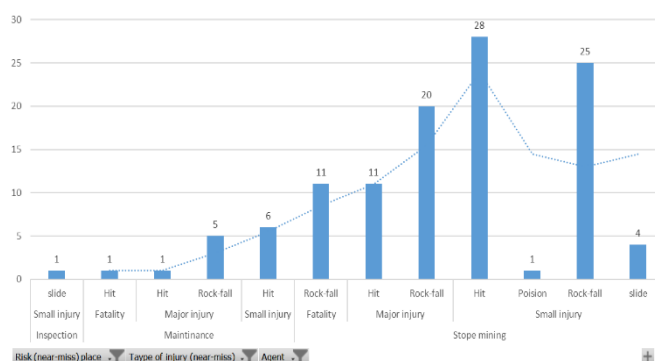


Figure 4. Near-Miss Incident-relation to workplaces and agents (hazards)

On the other hand, there is a common view in the mining industry that human error plays a substantial role in fatalities. This includes accidental error, as well as errors caused by employees deliberately ignoring safety rules and conducting activities in an unsafe manner. A total of 17 of the 47 fatalities were due to a lack of task-specific training and/or competence for the tasks performed [18]. As in Figure 4, informal reporting on near-miss incidents is shown, with some of which are not even informally reported. Hopkins emphasizes that when an industry or organisation is focused on identifying early warnings signs of future catastrophes, encouraging incident reporting is critical. He emphasizes that the purpose is not necessarily to increase the number of reports of injuries, but to increase the number of reports of events that highlight that certain hazards are not properly controlled, in other words, to identify ineffective control measures. He also highlights the importance of reporting quality over quantity, and the fact that getting people to report is a real challenge [21].

### 3.1. Statistical data analysis and results interpretation

In this research, the target community was employees involved in mining operation (metal and non-metal mines), dedicated employees employed in different units of mining operations within the studied area. Thus, for this study, a randomly selected sample is represented by the targeted population. The data were collected through the application of organized questionnaires prepared and designed by the researcher. However, the questionnaires were distributed among the employees randomly. After data collection, the questionnaires were analysed using appropriate statistical – theoretical analysis and statistics software, such as SPSS 25v, in combination with Excel-Spread-Sheet.

As shown in Table 2, the strength correlation (ranging from -1 to +1) is between two variables that indicate near-miss incidents related to the workplace, that is mining production (variable/row, 1 and 2 variables indicate majority of near-miss incidents related to stope-mining and “hit-agent”) with the potential for serious incidents and fatalities.

**Table 2. The strength of correlation between survey “variables” in mining operation according to SPSS 25v**

Reported / no reported	Why did it happen	Near miss incident source	Workplace	Types of near-miss incidents	Number of near-misses per year	Year	Company	Working position	Variables S
0.125	0.151	0.007	0.825	0.148	0.040	-0.075	1.0	1	1
0.125	0.151	0.007	0.825**	0.148	0.040	-0.075	1.0		2
-0.105	0.127	0.067	-0.047	-0.064	-0.019	1.000			3
-0.156	0.234	-0.099	0.128	0.178	1.000				4
-0.008	0.013	-0.086	0.162	1.000					5
0.083	0.212*	-0.105	1.000						6
-0.014	0.101	1.000							7
-0.106	1.000								8
1.000									9

To calculate accident frequency rates for injuries, near-miss incidents, and property damage accidents, you need to know the number of accidents that have occurred and the number of hours employees have worked. Below are the formulas for calculating the “total accident frequency rate” and “near-miss incident frequency rate”:

$$\begin{aligned} \text{Total accident frequency rate} &= \\ &= \frac{(\text{number of accidents}) \cdot 200000}{\text{employee hours worked}} \end{aligned} \quad (1)$$

$$\begin{aligned} \text{Near – miss accident frequency rate} &= \\ &= \frac{(\text{number of near misses}) \cdot 200000}{\text{employee hours worked}} \end{aligned} \quad (2)$$

This number represents 200 thousand hours, which is roughly equal to the number of hours worked by 100 employees during a normal working year. Europeans tend to use 100 thousand hours, while others use one million hours in their rate calculations. As can be seen from Formula 1, the calculation of near-miss incidents is a crucial part of accident prevention, which actually represents the efforts and measures that must be taken to prevent accidents. The analysis of mining accidents is the right way to determine the risk in certain activities in the mining industry. The following text provides an equation based on the definition of risk in mining activities [22]:

$$A = \frac{P}{E} \cdot E'; \quad (3)$$

$$E' = \frac{t_2}{t_1}; \quad 8 \geq t_2 > 0.8 \geq t_1 > 0,$$

where:

- A – accident/risk assessment;
- P – accident occurrence parameter (small injury to disaster);
- E – exposure within space where accident may occur;
- t<sub>1</sub> – the regular working hours per shift, or the nominal exposure time;
- t<sub>2</sub> – the effective time of exposure;
- E' – time exposure ratio (Table 3, nominal rate P).

**Table 1. Relation between the nominal rate “P” and categorisation of accidents**

A	B
Nominal rate of accident occurrence parameter “P”	Nominal rate of “P” based on previous categorisation of accidents
0.90	Small injury
1.90	One lost time injury
2.90	Many lost time injuries
3.90	One permanent disability/less chance of fatality
4.90	Significant of fatality
5.90	One dead
6.90	Several dead
7.90	Disaster

### 3.2. Interpretation of near-miss incident (NMI) results

Figure 2 shows a number of near-miss incidents in the Kosovo mining industry over three years (2019-2021). Thus, during 2019, 24 accidents occurred, in 2020 – 16, and in



2021 – 31. The total number of near-miss incidents over the three years is 70. It should be noted that the number of fatalities in near-miss incidents has increased.

Based on Equation 2 and Figure 2, the average near-miss incident rate is 82% (number of NMI = 24 + 24·0.82 ≈ 44), the NMI rate for the Kosovo mining industry is about 4.0.

This means that for every 100 employees, 4.0 employees have been involved in a recorded number of near-miss incidents. Considering a total of 10000 employees, the approximate number of near-miss incidents could be 400 per year. The assumption is substantiated that the main agents (hazard) causing the largest number of accidents, including fatal ones, are rock-fall and hit agents, and the most dangerous workplaces are those related to stope-mining (production). Given this conclusion, Figure 3 shows the main agents (hazards) and dangerous workplaces based on a survey related to near-miss incidents in the Kosovo mining industry (2011-2021).

It can be concluded from Figure 3 that stope-mining is the most dangerous workplace, whereas the most dangerous agents (hazards) are hits and rock-falls. As can be seen from Figure 3, 11 fatalities of near-miss incidents have been registered during stope-mining. Thus, based on column “A” of Table 3, the nominal rate of accident occurrence (parameter “P”) ranges from 4.90 to 5.90 (average 5.4). Therefore, the definition of risk based on Equation 3 and given that  $t_2 = t_1 = 8$  hours ( $E' = 1$ ) is as follows:

$$A = \frac{P}{E} \cdot E' = \frac{5.4}{8} \cdot 1 = 0.675 = 67\% .$$

According to the determination of workplace and based on Figure 3, the “stope-mining” can be attributed to high-risk workplaces.

As shown in Figure 5, all near-miss incidents have been reported in an informal manner.

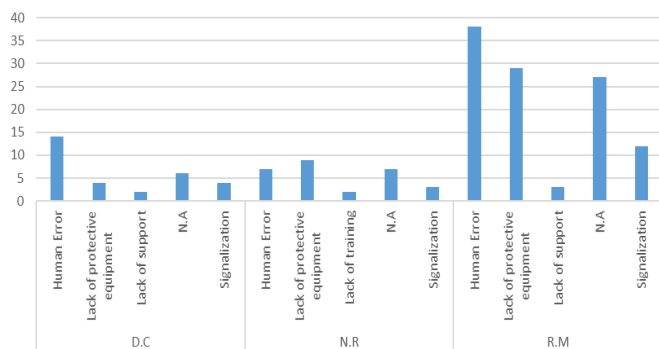


Figure 5. Presumption of cause of near-miss incidents, as well as their non-reporting and informal reporting (D.C – discussing with colleagues; N.R – non-reporting; R.M – reported to manager; N.A – no answer)

Thus, about 50% of near-miss incidents have not been reported even in an informal manner (as indicated by D.C and N.R in Figure 5). Hence, at best, the miners discussed it with their colleagues. Considering that 50% of near-miss incidents were reported to the direct manager, of course in an informal way and due to the lack of legislation, official data on such near-miss incidents have not been recorded. Consequently, no measures have been taken to conduct further additional investigation into the occurrence of near-miss incidents.

The x-axis in Figure 4 shows the lack of appropriate measures that could have affected the near-miss incident, such as human error, lack of signalisation, roof support and

lack of training, while N.A means that there is no idea why the near-miss incident occurred.

Computer simulation of mining accidents is the future of mining accident prevention. In this regard, it is recommended that further research work should be aimed at improving the reliability of reporting on mining accidents (including near-miss incidents) and their statistical processing. Therefore, this will increase the reliability of computer simulation results, such as the simulation model run by Fuzzy Logic Toolbox in MATLAB (rock-fall case).

#### 4. Conclusions

Near-miss incident (NMI) reporting seems to be a global challenge in the mining industry. Thus, near-miss incident reporting, investigation and analysis is as important as accident reporting and investigation in terms of mine safety management and accident prevention in the mining industry. The development of proper legislation, which requires reporting, recording, investigation and analysing of near-miss incidents in mining activities, will improve general safety in the mining industry, that is, prevent mining accidents.

A comprehensive study of the main causal factors of near-miss incidents should contribute to the adoption of appropriate measures to prevent mining accident and increase transparency in these data publication, thereby contributing to research work related to improving mining safety, that is, the prevention of accidents in mining activities. It is recommended that mining law must include near-miss incident reporting, employees should be trained and encouraged to report on near-miss incidents, while, safety management should analyse near-miss incidents in the context of mining accident prevention, thereby improving general safety in the mining industry.

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#### References

- [1] Van Der Schaaf, T.W., & Kanse, L. (2000). Errors and error recovery. *Human Error and System Design and Management*, (253), 27-38. <https://doi.org/10.1007/BFb0110452>
- [2] Mbuvi, I.M., Kinyua, R., & Mugambi, F. (2015). Near miss incident management, the root for an effective workplace safety is determined by the management commitment. *International Journal of Scientific and Research Publications*, 5(10), 1-13.
- [3] Zeqiri, K. (2020). Investigation of the mining accidents at “Stan Terg” mine. *Mining Science*, (28), 39-46. <https://doi.org/10.37190/msc202703>
- [4] Jones, S., Kirchsteiger, Ch., & Bjerke, W. (1999). The importance of near miss reporting to further improve safety performance. *Journal of Loss Prevention in the Process Industries*, 12(1), 59-67. [https://doi.org/10.1016/S0950-4230\(98\)00038-2](https://doi.org/10.1016/S0950-4230(98)00038-2)
- [5] Lauver, J.K., Lester, S.W., & Le, H. (2009). Supervisor support and risk perception: Their relationship with unreported injuries and near misses. *Journal of Managerial Issues*, 21(3), 327-343.
- [6] Tian, S.C., Kou, M., Sun, Q.L., & Li, L. (2014). Analysis of near miss reporting will in China coal mines: An empirical study. *Advanced Materials Research*, (962-965), 1127-1131. <https://doi.org/10.4028/www.scientific.net/AMR.962-965.1127>
- [7] Ibishi, G., Genis, M., & Yavuz, M. (2022). Post-pillars design for safe exploitation at Trepça hard rock mine (Kosovo) based on numerical modeling. *Geomechanics and Engineering*, 28(5), 463-475. <https://doi.org/10.12989/gae.2022.28.5.463>

- [8] Musasa, T., & Jerie, S. (2020). Challenges of near miss incidents reporting at a mine in the Midlands province of Zimbabwe. *Eastern Africa Social Science Research Review*, 36(2), 95-114. <https://doi.org/10.1353/eas.2020.0007>
- [9] Go, K. (2012). *Mining strategy of the Republic of Kosovo*. Prishtina, Kosovo: Government of Kosovo.
- [10] ICMM. (2022). Retrieved from: <https://kosovo-mining.org/publications/legislation/?lang=en>
- [11] Caldwell, J. (2013). Incidents and near missing in mining. *Australian Mining*. Retrieved from: <https://www.australianmining.com.au/features/incidents-and-near-missing-in-mining/>
- [12] NIOSH Mine and Mine Worker Charts. (2020). *The National Institute for Occupational Safety and Health*. Retrieved from: <https://www.cdc.gov/niosh/mining/statistics/default.html>
- [13] *Annual report for the year 2019*. (2020). Prishtina, Kosovo: Independent Commission for Mines and Minerals, 111 p.
- [14] Gerguri, F. (2022). *Near miss accidents reporting*. Prishtina, Kosovo: Korporata Energjetike e Kosovës.
- [15] Good, C. (2022). *Margin of error calculator*. Retrieved from: <https://goodcalculators.com/margin-of-error-calculator/>
- [16] NIOSH Mining. (2018). *Fatalities Cost in Mining Technical Guide*. Retrieved from: <https://www.cdc.gov/NIOSH-Mining/CostCalcsFatal/Help/TechnicalGuide>
- [17] Verma, A., Rajput, D., & Maiti, J. (2017). Prioritization of near-miss incidents using text mining and Bayesian network. *Advances in Computing and Data Sciences*, 183-191. [https://doi.org/10.1007/978-981-10-5427-3\\_20](https://doi.org/10.1007/978-981-10-5427-3_20)
- [18] Karmis, M. (2009). *Mine health and safety management*. Colorado, United States: Society for Mining, Metallurgy, and Exploration.
- [19] Ibishi, G., Yavuz, M., & Genis, M. (2020). Underground mining method assessment using decision-making techniques in a fuzzy environment: Case study, Trepça mine, Kosovo. *Mining of Mineral Deposits*, 14(3), 134-140. <https://doi.org/10.33271/mining14.03.134>
- [20] Zeqiri, K., Ibishi, G., Shabani, M., Kortnik, J., Bilir, M.E., Genis, M., Yavuz, M., Hetemi, M., & Bacak, G. (2021). Preliminary suport design for underground mine Adit, Artana mine, Kosovo. *Mining Science*, (28), 141-159. <https://doi.org/10.37190/msc212811>
- [21] Brady, S. (2019). *Review of all fatal accidents in Queensland mines and quarries from 2000 to 2019*. Queensland, Australia: Department of Natural Resources, Mines and Energy, 321 p.
- [22] Zeqiri, K., Kortnik, J., & Mijalkovski, S. (2020). Determination of the risk at workplace, assessment and its rank calculation, in mining activities. *Geoscience Engineering*, 66(1), 69-75. <https://doi.org/10.35180/gse-2020-0032>

## Аналіз звітування про потенційно небезпечні інциденти на гірничодобувних роботах

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**Мета.** Аналіз та розслідування потенційно небезпечних інцидентів під час гірничодобувних робіт у Косово на основі попередніх досліджень і обстежень на місці для управління безпекою і запобігання нещасним випадкам на шахтах.

**Методика.** З цією метою як інструмент спостереження були застосовані як якісні, так і кількісні методи за допомогою 115 анкет, розподілених випадковим чином серед працівників гірничодобувних компаній. Для аналізу зібраних даних використовувалося програмне забезпечення Excel та SPSS. Опитування було проведено, щоб отримати основну інформацію про кількість потенційно небезпечних інцидентів і про те, як вони виникли та були виявлені, а також щоб віднайти їхню схожість із нещасними випадками на шахтах, що сталися під час гірничодобувних робіт у Косово.

**Результати.** Дослідження показує, що гірничодобувна діяльність пов'язана з виробництвом і є переважним джерелом потенційно небезпечних інцидентів, які могли стати причиною аварії. Виявлено, що завдяки підходу якісного спостереження в різних гірничодобувних компаніях, більшість шахт не повідомляють навіть у неофіційний спосіб про небезпечні інциденти, які є потенційно загрозливими для працівників.

**Наукова новизна.** Всебічне вивчено та встановлено особливості основних впливових факторів, що спричиняють потенційно небезпечні інциденти, з метою покращення безпеки видобутку корисних копалин.

**Практична значимість.** Це дослідження систематизує джерела, фактори впливу, пов'язані з потенційно небезпечними інцидентами, а також аналізує найкращий досвід звітування про потенційно небезпечні інциденти з метою покращення управління безпекою гірничих робіт у межах гірничодобувної промисловості. Підвищення прозорості даних про потенційно небезпечні інциденти та їх оприлюднення мають сприяти дослідницькій роботі, пов'язаній з підвищенням безпеки гірничих робіт, іншими словами, попередженням аварій на шахтах.

**Ключові слова:** потенційно небезпечні інциденти, безпека, фактори впливу, травма, потенційний ризик