UTICAJ STRUČNE SPREME; GODINA RADNOG ISKUSTVA I MJESTA NASTANKA NA BROJ POVREDA NA RADU – PRIMJER RUDNIKA „ABID LOLIĆ BILA“

THE EFFECT OF PROFESSIONAL QUALIFICATIONS, YEARS OF WORK EXPERIENCES AND PLACES OF OCCURENCES OF INJURIES TO THE NUMBER OF INJURIES AT WORK - EXAMPLE OF THE BROWN COAL MINE „ABID LOLIĆ BILA“

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REZIME

Povreda na radu je neželjeni događaj koji se dešava na skoro svakoj vrsti posla. Posebno su izražene na teškim radnim mjestima kao što su rudnici, naročito sa podzemnom eksploatacijom, željezare sa radnim mjestima gdje su povišene temperature, hemijskoj industriji i slično. Jedan dio ovih povreda odvlači radnika od daljih aktivnosti na radnom mjestu te izaziva gubitak radnih sati. Zato svaki poslodavac odnosno osoba koju je on ovlastio, mora biti upoznat i s ostalim slučajevima koji se smatraju povredama na radu, kako bi zaposlenik ostvario i ostala svoja prava.

Svakako da ove povrede mogu nastati na različiti radnim mjestima, u zavisnosti od njihove težine i vrste, kao i da u njima učestvuju gotovo svi radnici bez obzira na stručnu spremu i godine iskustva u radu. U radu će se dati pregled broja povreda u Rudniku mrkog uglja „Abid Lolić Bila“ sa aspekta mjesta nastanka, odnosno vrste poslova koji se obavljaju, kao i vrste stručne spreme i godina iskustva provedenih na radu.

Preliminary notes

SUMMARY

Injury at work is an unwanted event that occurs on almost every type of job. Especially in heavy workplaces such as mines, especially underground exploitation, ironworks with workplaces where temperatures are high, chemical industry and the like. A part of these injuries will deprive the worker of further activities at the workplace and lose working hours. Therefore, every employer or person authorized by him must also be familiar with other cases considered to be injuries at work so that the employee can exercise his or her rights.

Of course, these injuries can occur at different workplaces, depending on their weight and type, and that almost all workers are involved, regardless of their qualifications and years of work experience. The paper will give an overview of the number of injuries in the brown coal mine "Abid Lolić Bila" from the spectacle of the place of origin, the kind of work being carried out, as well as the types of professional education and years of work experience.

1. UVOD

Organizacije, bez obzira na vrstu djelatnosti, sve više vode računa o zaštiti na radu i zaštiti zdravlja, upravljajući rizicima i poboljšavajući pozitivne učinke svojih aktivnosti, proizvoda i usluga, a to onda i pokazuju svojim dioničarima, zaposlenicima, klijentima i drugim zainteresiranim stranama. Obvezujuća regulativa, razvoj ekonomske politike, upravljanje ljudskim resursima i druge mjere sve se više koriste za poticanje razvoja zaštite na radu i zaštite zdravlja.

1. INTRODUCTION

Organizations, regardless of their type of activity, are increasingly taking into account occupational safety and health protection, managing risks and improving the positive effects of their activities, products and services, and then present it to their shareholders, employees, customers and other stakeholders. Compulsory regulation, economic policy development, human resource management and other measures are increasingly used to foster the development of occupational safety and health protection.

Iz općeg porasta zabrinutosti dioničara i drugih zainteresiranih strana nastala je preporuka, a onda i zahtjev za jasnim opredjeljenjem za zaštitu na radu i zaštitu zdravlja zaposlenika.
Preko 6300 osoba izgubi život na radnom mjestu ili bolest povezana s radom ima fatalne posljedice, godišnje nestane 2,3 milijuna zaposlenih [1]. Teret ozljeda i bolesti je značajan, kako za poslodavce tako i za privredu, sve to rezultira gubicima zbog ranih penzionisanja, nedostatkom kvalificiranog i kompetentnog osoblja te diže premije osiguranja.
Iz prakse je poznato da se pri obavljanju nekih poslova događa znatno više nezgoda nego pri obavljanju drugih poslova. Tako se, zbog različitog stepena opasnosti, događa više nezgoda pri obavljanju strojobravarskih, rudarskih, metalurških, hemijskih poslova nego pri obavljanju kancelarijskih poslova.
Ali, pri obavljanju poslova jednakog stepena opasnosti primjećuju se znatne razlike u učestalosti nezgoda kod pojedinaca. Dakle, nezgode na radu osim o objektivnim prilikama, ovise i o osobinama (subjektivnim) radnika i ne može se govoriti o faktoru slučajnosti. Nezgode pri radu nastaju kao posljedica poremećaja u odnosima čovjeka i radne okoline.
Povreda je krajnja karika u lancu uzroka koji su je prouzročili. Povredi prethodi nezgoda kao neželjeni neplanirani događaj. Nezgodi prethodi nečija pogreška. To je u osnovi ljudska pogreška, koja može biti direktna (kada radnik radi suprotno pravilima zaštite na radu i sam nastrada), ali i indirektna, kada pogriješi netko drugi, a radnik nastrada (projektant, proizvođač stroja, voditelj poslova ili drugi radnik).
Svi neočekivani poremećaji ovog odnosa ne završavaju povredom. Statistički podaci govore, da se na 330 takvih poremećaja ili rizika, 300 puta ne dogodi ništa, odnosno, nema nikakvih štetnih posljedica, 29 puta se dogodi opasni poremećaj (slučajevi koji "zamalo nisu izazvali povredu "), a jedanput nastaje povreda, Slika 1. [1]
Svaka povreda predstavlja teret za pojedinca, njegovu obitelj i širu zajednicu. Ključ rješenja je u sprečavanju nezgoda leži u odnosu čovjek – radna okolina. U neodgovarajućoj okolini nema sigurnog rada. Najvažnije je da znamo da i na čovjeka i na radnu okolinu možemo utjecati.
Pogreške nastaju najčešće zbog toga što radnik:

- ne zna raditi sigurno,
- ne može raditi sigurno ili
- ne želi raditi sigurno.

There was a general rise in concerns of shareholders and other interested parties, and then a demand for a clear commitment to occupational safety and health protection.
More than 6300 people lose their lives while working or the work-related illness has fatal consequences, 2,3 million people disappear annually [1]. The burden of injury and illness is significant both for employers and for the economy, all of which results in losses due to early retirements, lack of qualified and competent staff and rising insurance premiums.
It is known from the practice that there are lots of more accidents occurring when doing certain works than doing other jobs. Thus, due to a different degree of danger, there are more accidents in performing stoneware, mining, metalurgical and chemical jobs than in performing office affairs.
But, in performing works of the same degree of danger, there are considerable differences in the frequency of accidents in individuals. Thus, accidents at work, except for objective opportunities, depend on the (subjective) worker's characteristics and there cannot be said about the coincidence factor. Work disruptions arise as a result of disturbances in the relationship between man and the working environment.
The injury is the final link in the chain of causes that caused it. Injury is preceded by an accident as an unwanted unplanned event. Accident is preceded by someone's mistake. This is basically a human error, which can be direct (when a worker is in contravention of occupational safety and self-injuries), but also indirect when someone else is wrong, and a worker is injured (designer, machine manufacturer, job manager, or other worker).
All unexpected disorders of this ratio do not end with injury. Statistics show that at 330 such disturbances or risks, nothing happens in 300 cases, and there are no damaging effects, but 29 times a dangerous disorder occurs (cases that have "almost caused no injury"), Picture 1. [1]
Every injury is a burden to the individual, his family, and the wider community. The key solution in preventing accidents lies in the relationship between man and working environment. There is no safe work in an unsuitable environment. The most important thing is to know that we can influence both man and the working environment.
Errors occur most often because a worker:

- does not know to work safely,
- cannot work safely or
- does not want to work safely.

Slika 1. *Odnos nezgoda i povreda [1]*
Picturet 1. *Ratio between accidents and injuries [1]*

Ti problemi mogu se uspješno riješiti prilagodbom radne okoline čovjeku (uređenjem radnog prostora, izvedbom sigurnih sredstava za rad i sl.) te prilagodbom čovjeka radnoj okolini (formiranjem pravilnog stajališta, školovanjem i osposobljavanjem, te pravilnim odabirom ljudi).

2. KLASIFIKACIJA POVREDA NA RADU

Povrede na radu su prvi negativni pojavni oblici nepovoljnih uslova rada, koje se odražavaju na živote i zdravlje učesnika u procesu proizvodnje. Osim toga, ove negativne neposredne posljedice nepovoljnih uslova rada prouzrokuju i negativne neposredne posljedice koje imaju ekonomski karakter.

Za uspešnu obradu borbu protiv povreda na radu mora se znati gdje, kada, kako i zašto se dešavaju povrede i kakve su njihove posljedice. Ova znanja se stiču proučavanjem pojedinih povreda i cjelishodnom upotrebom rezultata klasifikovanih u što homogenije kategorije onih elemenata povreda koji su najkorisniji za preventivu. Zbog toga evidencije povreda na radu, a pogotovo statistike povreda u cjelini, su preventivno usmjerene na upoznavanje etiologije nastanka povreda na radu, tj. zašto i kako dolazi do povreda. Svrha ovih proučavanja je težnja da se upozna etiologija nastanka, kako bi bili u prilici da preuzmemo odgovornije mjere za sprečavanje nastanka povreda na radu u konkretnoj radnoj sredini.

These problems can be solved successfully by adjusting the working environment to a man (by arranging the work space, performing safe work tools, etc.) and by adapting man to the working environment (by establishing a proper attitude, education and training, and proper selection of people).

2. CLASSIFICATION OF THE WORK INJURIES

The work-related injuries are the first negative forms of adverse working conditions that reflect the lives and health of the participants in the production process. In addition, these negative direct consequences of unfavorable working conditions also cause negative direct consequences of an economic nature.

For the successful treatment of injury at work, one has to know where, when, how and why the injuries occur and what are their consequences. This knowledge is acquired through the study of individual injuries and the overall use of results classified into a homogeneous category of those elements of injury that are most useful for prevention. Therefore, records of injuries at work, especially injury statistics as a whole, are preventively aimed at getting to know the etiology of injury at work, i.e. why and how injury occurs. The purpose of these studies is to find out the etiology of origin in order to be able to take more responsible measures to prevent injuries at work in a specific work environment.

Inače, na upoznavanje etiologije nastanka povreda na radu usmjeren je cijeli niz traženih obilježja, koje želimo da saznamo pri svakoj povredi na radu. Zbog toga je neophodno potrebno da se izvrši klasifikacija povreda na radu, jer je ona osnova svakog naučnog uopštavanja i zbog toga je bitan elemenat statističke metodologije.
Inače, statistička klasifikacija povreda na radu mora biti ograničena na određeni broj kategorija. Kao važna obilježja u tom smislu smatraju se, prije svega [3]:

- vrijeme dešavanja,
- mjesto dešavanja,
- pol,
- doba života,
- dužina radnog staža,
- zanimanje,
- školska sprema,
- učestalost dešavanja povreda na radu kod pojedinaca,
- pojedinačne ili grupne povrede (broj povređenih),
- težina povrede,
- povređeni dio tijela,
- priroda povrede,
- izvor povrede,
- uzrok povrede,
- način nastanka i dr.

Povrede na radu mogu se klasifikovati još i prema drugim faktorima koji su interesantni za analizu povreda, kao što su klasifikacije prema:

- odjeljenjima,
- privrednim djelatnostima,
- granama industrije i dr.

Svako od navedenih obilježja doprinosi nepovoljno ili, najčešće, posredno boljem poznavanju etiologije nastanka povreda na radu. Inače, analiza svih tih obilježja je dosta teška i traži temeljita poznavanja statističke metodike.granama industrije i dr.

U okviru ovog rada opredijelili smo se da izvršimo sagledavanje uticaja mjesta rada radnika na broj povreda (mjesta karakteristična za unutrašnje kopove), stepena uticaja školske spreme i stepena stručnog obrazovanja, te godinama iskustva radnika na nastanak povreda. Ova saznanja omogućila bi preuzimanje adekvatnih mjera zaštite na radu.

Otherwise, a variety of features that we want to find out about every injury at work is focused at getting to know the etiology of injury at work. It is therefore necessary to perform a classification of injuries at work, as it is the basis of every scientific intervention, and is therefore an essential element of statistical methodology.

Otherwise, the statistical classification of injuries at work must be limited to a number of categories. As important features in this regard are considered above all [3]:

- the time of the event,
- the place of events,
- gender,
- age of life,
- length of working experience (service),
- interest,
- degree of education,
- frequency of injuries at work with individuals,
- individual or group injuries (number of injured),
- the severity of the injury,
- the injured part of body,
- the nature of the injury,
- source of injury,
- the cause of the injury,
- the way of creation and others.

Injuries at work can be classified in addition to other factors that are of interest to injury analysis, such as classification according to:

- - departments,
- economic activities,
- branches of industry and others.

Each of these features contributes to the unfavorable or, most often, indirectly better understanding of the etiology of the occurrence of injuries at work. Otherwise, the analysis of all these features is quite difficult and requires thorough knowledge of statistical methodology.

Within this paper, we have determined to look at the impact of the workplace's on the number of injuries (places that are characteristic of internal mines), the degree of impact of school education and the level of vocational education, and years of worker experience on the occurrence of injuries. This knowledge would enable the taking of adequate protection measures at work.

3. RUDNIK MRKOG UGLJA "ABID LOLIĆ", BILA - TRAVNIK

Rudnik Kakanj započeo je 1942-1943 godine istraživanja u području Bile, mogućih ležišta mrkog uglja, sektor Karahođe - Pokrajčići. Nakon kraće pauze, istraživanja su nastavljena do kraja 1946 godine. Rudnik Bila osnovan je rješenjem Okružnog suda Travnik 19.10.1947 godine, upisan u registarsku knjigu privrednih organizacija kod Okružnog suda Travnik 23.02.1948 godine i kod privrednog Okružnog suda Sarajevo 27.01.1955 godine.

U periodu 1955-2009 godine, rudnik je u određenim vremenskim periodima djelovao u sastavu rudnika „Srednja Bosna" ili kao samostalni privredni subjekt. Prije ulaska u sastav koncerna JP EP d.d. Sarajevo, rudnik je djelovao kao samostalni privredni subjekt. Odlukom Vlade Federacije o prenosu udjela Federacije BiH u rudnicima uglja na JP EP BiH d.d. Sarajevo, službene novine FBiH broj 4/09, rudnik ulazi u sastav koncerna JP „Elektroprivreda" d.d. Sarajevo kao Zavisno Društvo. Osnovna djelatnost Društva je proizvodnja, prerada i plasman uglja uz povremeno korištenje ostalih djelatnosti koje su upisane u sudski registar. Ova statusna promjena olakšala je i definisala budući koncept razvoja rudnika.

Teritorijalno područje rudnika Bila pripada opštini Travnik. Površina eksploatacionog polja iznosi 22 km^2 sa eksploatacionim rezervama 9,5 mil. tona i perspektivom eksploatacije 150 godina. Položaj Rudnika dat je na Slici 2.

U periodu 2012-2014 godina, poslovanje društva obilježeno je velikim investicijskim ulaganjima, (15 mil. KM), na izradi glavnih ventilaciono-transportnih prostorija sa ciljem stvaranja pretpostavki za otvaranje, razradu i eksploataciju novih rezervi uglja u bloku TB-6, što je ujedno značilo i otklanjanje neizvjesnosti u kontinuitetu poslovanja i razvoja Društva. Broj uposlenika u Društvu je u tom periodu bio 356, sa ugovorom o radu na neodređeno vrijeme 271 uposlenik i 85 uposlenika sa ugovorom o radu na određeno vrijeme. Prema planskim i razvojnim dokumentima Društva, kao i projektovanim količinama vlasnika, proizvodnja iz jame u datom periodu je bila 122 000 tona uglja, u 2015 godini, treba ostvariti rast na 180 000 tona, odnosno 47,5%.

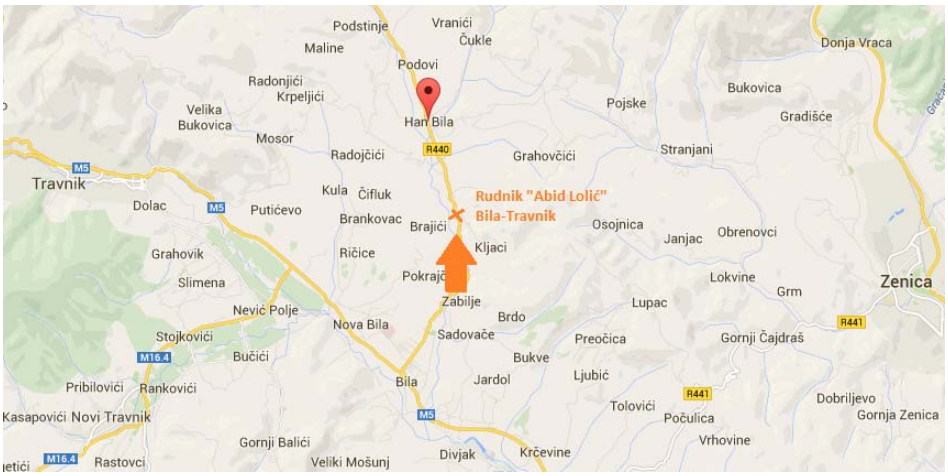
3. BROWN COAL MINE "ABID LOLIĆ" Ltd. BILA - TRAVNIK

The Kakanj mine started functioning in 1942-1943 in the area of Bila, possible brown coal deposits, the Karahođe - Pokrajčići section. After a shorter break, the research continued until the end of 1946. The Coal Mine Bila was established by the District Court Travnik on 19 October 1947, entered in the register of commercial organizations at the Travnik District Court on 23 February 1948 and at the Commercial District Court of Sarajevo on 27 January 1955.

In the period 1955-2009, the coal mine had, for certain periods of time, been part of the "Middle Bosnia" mining or as an independent economic entity. Prior to entering the composition of JP EP Ltd. Sarajevo, the mining acted as an independent economic entity. By the decision of the Government of the Federation on the transfer of the share of the Federation of Bosnia and Herzegovina to coal mines at the EP EP BiH Ltd. Sarajevo, Official Gazette of FB&H No. 4/09, the mining company enters the group of companies JP "Elektroprivreda" Ltd. Sarajevo as a Subsidiary. The Company's core business is the production, processing and placement of coal, with the occasional use of other activities registered in the court register. This status change has facilitated and defined the future concept of mine development.

The territorial mine area of Bila belongs to the municipality of Travnik. The exploitation field area is 22 km^2 with exploitation reserves of 9.5 million tons and 150 years of exploitation prospects. The location of the mine is given in Picture 2.

In the period 2012-2014, the business of the company was marked by large investment investments, (BAM 15 million), on the development of the main ventilation-transport rooms, with the aim of creating the preconditions for the opening, elaboration and exploitation of the new coal reserves in the TB-6 block which also meant eliminating uncertainty in the continuity of business and development of the Company. The number of employees in the Company was 356 in that period, with an employment contract for an indefinite period of 271 employees and 85 employees with a fixed-term contract. According to the Company's planning and development documents, as well as the projected quantities of owners, production from the pit in the given period was 122,000 tons of coal, in 2015, a growth of 180,000 tons and 47,5% respectively.



Slika 2. *Pozicija rudnika u odnosu na Travnik i Zenicu*
Picture 2. *The location of coal mine in relation to Travnik and Zenica*

4. EKSPERIMENTALNO ISTRAŽIVANJE

4.1. Uvod

U ovom primjeru prezentovani su rezultati eksperimentalnog istraživanja o povredama u Rudniku „Abid Lolić Bila“ za period 2013-2017. godina. Ti podaci su sortirani prema zvaničnim godišnjim izvještajima o povredama, službe zaštite za posmatrani period. Za obradu podataka korištene su opcije u Excel-u, Trendline i Anova. Alat Anova koristi se za analizu varijanse koja predstavlja statističku metodologiju određivanja karaktera i jačine uticaja jednog ili više faktora na posmatrani objekt ili proces. Povrede su vezane za stručnu spremu uposlenika, određene grupe godina radnog iskustva, i mjesto (radilište) nastanka povrede za koje se direktno vežu određeni radni zadaci. Vremenski period posmatranja od pet godina sigurno je dovoljan period za definisanje određenih zaključaka.

4.2. Broj povreda prema mjestu nastanka

Radilišta su svrstana u 5 grupa koja su karakteristična za rudnike sa jamama. To su:

- Pripremno radilište,
- Komorni otkop,
- Sanacija jamskih prostorija,
- Tranasportni i drugi putevi i
- Separacija (van jame).

U Tabeli 1. dat je pregled povreda prema mjestu nastanka (radilištu), u posmatranom vremenskom periodu. Tabela 2. daje pregled rezultata frekvencija povreda na osnovu podataka iz Tabele 1. Slika 3 prikazuje histogram frekvencija povreda prema podacima iz Tabele 1.

4. EXPERIMENTAL RESEARCH

4.1. Introduction

In this example, the results of the experimental research on injuries in the "Abid Lolić Bila" brown coal mine for the period 2013-2017 were presented. These data are sorted according to official annual injury reports, protection services for the observed period. Data processing was used in Excel, Trendline and Anova. The Anova tool is used to analyze the variance that represents the statistical methodology of character determination and strength of one or more factors on the observed object or process. The injuries are related to the professional qualification of the employee, a certain group of years of work experience, and the place (work site) of the injury to which they directly associate certain tasks. The five-year observation period is certainly a sufficient period for the definition of certain conclusions.

4.2. Number of injuries by the place of origin

The work sites are divided into 5 groups that are characteristic for coal mines with pits. These are:

- Preparatory work site,
- Compression mine,
- Repair of pit rooms,
- Transports and other routes, and
- Separation (outside the pit).

Table 1 gives an overview of the injury to the place of origin (work site) in the observed period of time. Table 2 shows the results of the injury frequency results based on the data from Table 1. Chart 3 shows the histogram of the frequency of injuries according to the data from Table 1.

Iz ovako grupisanih i prezentovanih rezultata, vidljivo je da se 56% povreda dogodilo na poslovima koji se odvijaju u transportnim i drugim putovima, dok se na komornom otkopu dogodilo 12% povreda. Komorno radilište je najopasnije radilište u rudnicima sa komornim otkopom uglja, dok su transportni putovi sa stanovišta sigurnosti najsigurnija mjesta u rudniku. Broj povreda govori da se u komornim radilištima primjenjuju mjere zaštite na visokom nivou i da oprez i kontrola radnika na tom radilištu je vrlo visoka u funkciji samozaštite od povreda. Broj povreda u transportnim i drugim putovima, korespondira sa podacima o broju povreda prema kvalifikacionoj strukturi uposlenih u ovom slučaju NK radnika.

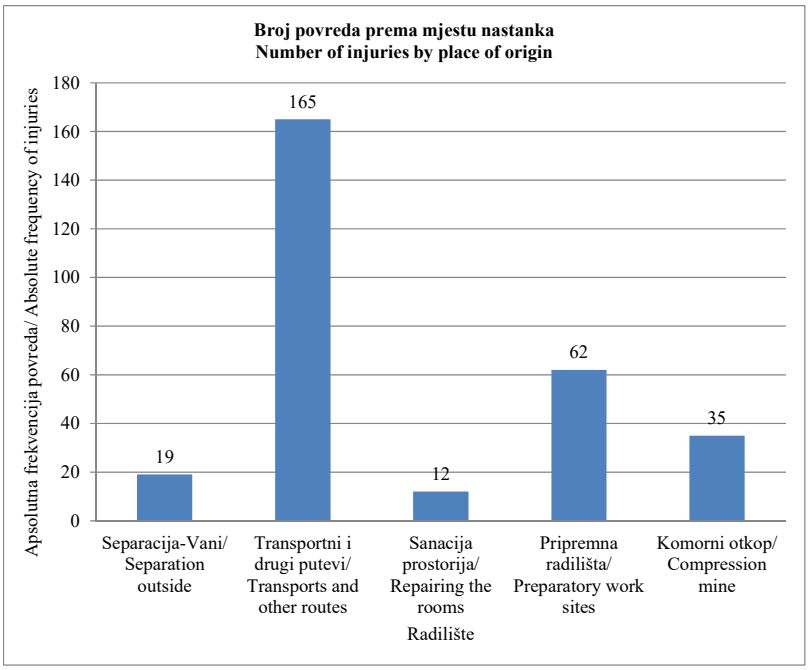
From this grouped and presented results, it is apparent that 56% of the injury occurred in the operations taking place in transport and in other ways, while 12% of the injuries occurred on the chamber. A rigid work site is the most dangerous site in mines with coal digging, while safety trains are the safest places in the mine. The number of injuries suggests that high-level protection measures are being applied in the workshops and that the safety and control of workers at that site is very high in self-protection. The number of injuries in transport and other routes corresponds to the number of injuries to the qualifying structure of the employees in this case of unskilled workers (low level of education).

Tabela 1. *Pregled povreda po mjestu nastanka (radilištu) u periodu 2013-2017 godina [5]*
Table 1. *Overview of injuries by the place of origin (work sites) [4]*

Radno mjesto/ godina Work site /Year	Pripremno radilište Preparatory work site	Komorni otkop Compression mine	Sanacija jamskih prostorija Repair of pit rooms	Transportni i drugi putevi Transports and other routes	Separacija, vani Separation outside the pit	Ukupno Total
2013	6	6	0	11	6	29
2014	10	7	2	23	6	48
2015	9	5	5	20	1	40
2016	20	8	1	64	1	94
2017	17	9	4	47	5	82
Ukupno - Overall ∑	62	35	12	165	19	293
Prosječna vrijednost Average value	12,4	7	2,4	33	3,8	58,6

Tabela 2. *Frekvencija povreda po mjestu nastanka (radilištu) u posmatranom periodu 2013-2017. godina prema Tabeli 1*
Table 2. *Frequency of injuries at the place of origin (work sites) in the observed period 2013-2017 according to the Table 1.*

Radno mjesto Work site	Apsolutna frekvencija Absolute frequency	Kumulativna Cumulative	Relativna frekvencija Relative frequency	Relativna frek. x 100% Relative freq. x100%
Separacija,Vani Separation outside	19	19	0,07	7
Transportni i drugi putevi Transports and other routes	165	184	0,56	56
Sanacija prostorija Repairing the rooms	12	196	0,04	4
Pripremna radilišta Preparatory work sites	62	258	0,21	21
Komorni otkop Compression mine	35	293	0,12	12
UKUPNO - OVERALL	293		1,00	100



Slika 3. *Ukupan broj povreda prema mjestu nastanka za period 2013-2017. godina [5]*
Picture 3. *Total number of injuries by place of origin for the period 2013-2017. [5]*

Ovi podaci upućuju nas na zaključak da se mjere zaštite i samozaštite ne poštuju u potrebnoj i zakonom predviđenom nivou na radnim zadacima u transportnim i drugim putovima. Drugi mogući razlog je u lošoj izvedbi prostorija za transport i druge putove, neredovna sanacija tih prostorija, postavljanje postrojenja i opreme u tim prostorijama nije u skladu sa propisanim pravilima i dodatno ugrožavaju sigurnost radnika. Rezultati analize varijanse dati u Tabelama 3. i 4. upućuju nas na zaključak da radni zadaci vezani za radilišta ovako grupisana u rudniku, **bitno utiču** na broj povreda.

These data point us to the conclusion that protection measures and self-protection are not respected in the required and statutory level of work duties in transport and other ways. Another possible reason is the poor performance of transport rooms and other routes, inauspicious repair of these premises, installation of equipment and equipment in these premises is not in accordance with the prescribed rules and further jeopardize worker safety. The results of the variance analysis given in Tables 3 and 4 point to the conclusion that work assignments related to sites thus grouped in the mine have **a significant impact** on the number of injuries.

Tabela 3. *Rezultati proračuna za podatke prema Tabeli 1.*
Table 3. *The results of calculation for the data according to Table 1.*

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Separacija-Vani Separation-Outside	5	19	3,8	6,7
Transportni i ostali putevi Transports and other routes	5	165	33	477,5
Sanacija prostorija Reparation of rooms	5	12	2,4	4,3
Pripremna radilišta Preparatory work sites	5	62	12,4	34,3
Komorni system Compression mine	5	35	7	2,5

Tabela 4. *Rezultati analize varijanse za podatke prema Tabeli 1.*
Table 4. *The results of analysis of variance according to Table 1.*

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	3125,84	4	781,46	7,438226	0,000769	2,866081
Within Groups	2101,2	20	105,06			
Total	5227,04	24				

4.3. Broj povreda prema stručnoj spremi

Podaci o povredama na radu prema stepenu stručnog obrazovanja povređenih radnika pokazuju kako i u kojoj mjeri stručnost radnika utiče na povređivanje. Na taj način se omogućava sagledavanje uloge stečenog stručnog obrazovanja kod nastanka povreda na radu u procesu rada.

Na osnovu podataka iz [2] može se zaključiti da se u Centralnoj Srbiji najčešće povređuju kvalifikovani radnici (KV), jer njihovo učešće iznosi čak 47,4% u odnosu na ukupan broj povreda na radu. Nakon toga, dolaze nekvalifikovani (NK) i polukvalifikovani radnici (PKV) koji u ukupnom broju povreda na radu u čestvuju sa 35,0%. Znači, na ove dvije grupe radnika otpada čak 82,4%, dok preostale stručne spreme učestvuju samo sa 17,6%. Osnovni razlozi zašto se ovoj grupaciji radnika dešava najveći broj povreda na radu su sljedeći:

- nekvalifikovani, polukvalifikovani i kvalifikovani radnici obavljaju najčešće i najopasnije poslove u preduzećima u kojima su zaposljeni uz intenzivni rad koji diktira tehnološki proces,
- ova grupacija radnika obavlja svoje poslove najčešće u nepovoljnim radnim uslovima (buka, vibracije, niska ili visoka temperatura, prašina, rad u smjenama i dr.),
- visoko učešće nekvalifikovanih, polukvalifikovanih i kvalifikovanih radnika u ukupnom broju zaposlenih i
- nedovoljna znanja iz oblasti zaštite na radu.

Nakon ove grupacije radnika, po brojnosti povreda dolaze radnici sa srednjom školskom spremom (SSS) – 7,8% i visokokvalifikovani radnici (VKV) – 6,9%. Znači, na ove dvije grupacije zaposlenih u Centralnoj Srbiji otpada 14,7% u odnosu na ukupan broj svih povreda na radu.

U Centralnoj Srbiji se najmanje povređuju radnici sa završenim šestim stepenom stručne spreme – 1,0%, odnosno sedmim stepenom – 1,9%.

4.3. Number of injuries by the professional skills

Data on injuries at work according to the level of professional education of injured workers show how and to what extent worker expertise affects the injury. In this way, it is possible to look at the role of vocational education acquired when work injuries occur in the work process.

Based on data from [2] it can be concluded that in Central Serbia the most commonly injured are the qualified workers (KV), because their participation amounts to as much as 47.4% of the total number of injuries at work. Thereafter, there are unskilled (NK) and semi-qualified workers (PKV), who in the total number of injuries at work account for 35.0%. This means that 82.4% of the workers in these two groups of workers are left, while the remaining professional qualifications account for only 17.6%. The main reasons why this group of workers has the greatest number of injuries at work are as follows:

- Unskilled, semi-qualified and qualified workers perform the most common and most dangerous jobs in companies where they are employed with intensive work that dictates the technological process,
- this group of workers performs their jobs most often in adverse working conditions (noise, vibration, low or high temperature, dust, shift work etc.)
- High participation of non-qualified, semi-qualified and qualified workers in the total number of employed, and
- insufficient knowledge in the field of occupational safety.

After this group of workers, the number of injuries comes from secondary school workers (SSS) - 7.8% and highly qualified workers (VKV) - 6.9%. Thus, these two groups of employees in Central Serbia account for 14.7% of the total number of injuries at work.

In Central Serbia, workers with a sixth degree of professional qualification are at least injured - 1.0%, respectively at the seventh grade - 1.9%.

Ove dvije grupacije radnika se najmanje povređuju (2,9%), prije svega zbog činjenice da oni svoje poslove obavljaju na manje rizičnim radnim mjestima, pa su po brojnosti manje zastupljeni u ukupnom broju radnika i da raspolažu adekvatnijim znanjima o zaštiti na radu.
Podaci iz Tabele 5 i Tabele 6 daju nam jasnu sliku povreda i frekvenciju povreda u posmatranom vremenskom periodu 2013-2017. godina, prema kvalifikacionoj strukturi uposlenika. Jasno je iz ovih podataka da se 50 % povreda odnosi na nekvalifikovane uposlenike (NK), 27 % za kvalifikovane uposlenike (KV) itd.
Navodimo i istraživanje [4] provedemo u Arcelor Mittal Zenica koje je provedeno u periodu 2005-2012. U tom istraživanju se navodi da se broj povreda na radu signifikantno smanjivao svake godine; 259 povreda (2005.godina), 86 (2006.), 55 (2007.), 95 (2008.), 32 (2009.), 28 (2010.), 19 (2011.). U 2012. godini registrovano je 15 povreda na radu, od kojih je 12 (80%) bilo lakših i 3 (20%) težih povreda. U tom periodu nije bilo povreda sa smrtnim ishodom. Povredama su najčešće bili zahvaćeni ekstremiteti (60%). Povrijeđeni su bili samo muškarci, i najčešće u prvoj smjeni (46,6%). **Najveći broj povrijeđenih su bili kvalifikovani radnici KV (67%).**
Na Slici 4. dat je histogram ukupnog broja povreda za podatke iz Tabele 5 koji jasno prikazuju odnos povreda prema kvalifikacionoj strukturi. Tabele 7. i 8. daju prikaz rezultata analize varijanse za podatke prema Tabeli 5. Tabela 6. sadrži podatke o broju posmatranja (5 god.), srednje vrijednosti i varijanse za svaki nivo kvalifikacione strukture.
Ocjena diferencirajućih efekata faktora izračunava se po poznatoj metodologiji (za VSS iznosi α_1= - 8,17, …, NK α_7=21,03).

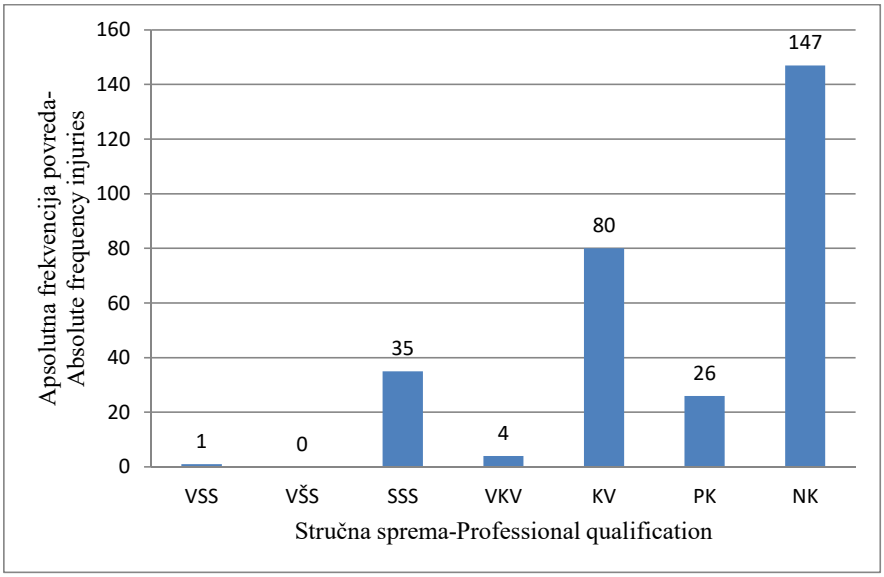
These two groups of workers are least affected (2.9%), primarily due to the fact that they carry out their jobs at less risky workplaces, so that the number of workers is less represented in the total number of workers and that they have more adequate knowledge of occupational safety.
The data from Tables 5 and Tables 6 give us a clear picture of the injury and frequency of the injury in the observed period 2013-2017, according to qualifying structure of employees. It is clear from this data that 50% of injuries are related to unskilled staff (NK), 27% for Qualified Employees (KV), etc.
We also cite the research [4] conducted at Arcelor Mittal Zenica conducted in the period 2005-2012. That study stated that the number of injuries at work was significantly reduced each year; 259 injuries (2005), 86 (2006), 55 (2007), 95 (2008), 32 (2009), 28 (2010), 19 (2011). In 2012, 15 occupational injuries were registered, of which 12 (80%) were minor and 3 (20%) were serious injuries. There were no fatal injuries during that period. Extremities were most commonly affected by injuries (60%). Only men were injured, most often on the first shift (46.6%). **The highest number of injured were Qualified Employees (KV) (67%).**
In Figure 4, there is a histogram of the total number of injuries for the data from Table 5 which clearly shows the ratio of the injury to the qualifying structure. Tables 7 and 8 show the results of the variance analysis for the data according to Table 5. Table 6 shows data on the number of observations (5 years), average values and variances for each qualifying structure level. The rating of differentiating factor effects is calculated by the known methodology (for VSS values α1 = - 8.17, ..., NK α_7 = 21.03).

Tabela 5. Pregled povreda u posmatranom periodu 2013-2017. god. po stručnoj spremi [5]
Table 5. Overview of injuries in the observed period 2013-2017 by professional qualification [5]

Stručna sprema / Professional skills / Godina-Year	VSS	VŠS	SSS	VKV	KV	PK	NK	Ukupno Total
2013.	0	0	9	0	7	4	9	29
2014.	0	0	5	0	15	6	22	48
2015.	0	0	4	2	15	2	17	40
2016.	1	0	8	0	22	4	59	94
2017.	0	0	9	2	21	10	40	82
Ukupno-Overall ∑	1	0	35	4	80	26	147	293
Prosječna vrijednost Average value	0,2	0	7	0,8	16	5,2	29,4	58,6

Tabela 6. Frekvencija povreda prema stručnoj spremi na osnovu podataka iz Tabele 5 za posmatrani period 2013-2017. godina
Table 6. Frequency of injuries by professional qualification based on data from Table 5 for the observed period 2013-2017

Stručna sprema Professional qualification	Apsolutna frekvencija Absolute frequency	Kumulativna Cumulative	Relativna frekvencija Relative frequency	Relativna frek. x 100% Relative freq. x100%	Apsolutna frekvencija Absolute frequency
VSS	1	1	0,003	0,3	0,3
VŠS	0	1	0,0	0,0	0,3
SSS	35	36	0,12	12,0	12,3
VKV	4	40	0,013	1,3	13,6
KV	80	120	0,27	27,0	40,6
PK	26	146	0,09	9,0	49,6
NK	147	293	0,5	50,0	100,0
Ukupno-Overall	293		1,0	100,0	



Slika 4. *Ukupan broj povreda prema stepenu stručnosti za period 2013-2017. godina [5]*
Picture 4. *Total number of injuries by the level of skills for the period 2013-2017 [5]*

Tabela 7. *Rezultati proračuna za podatke iz Tabele 5*
Table 7. *The results of calculation for the data from Table 5*

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
VSS	5	1	0,2	0,2
VŠS	5	0	0	0
SSS	5	35	7	5,5
VKV	5	4	0,8	1,2
KV	5	80	16	36
PK	5	26	5,2	9,2
NK	5	147	29,4	403,3

Tabela 8. *Rezultati analize varijanse za podatke iz Tabele 5*
Table 8. *The resuls of analysis of variance for the data from Table 5*

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	3532,571	6	588,7619	9,049919	1,56E-05	2,445259
Within Groups	1821,6	28	65,05714			
Total	5354,171	34				

Tabela 8. je svodna tabela za analizu varijanse jednofaktornog plana eksperimenta. Kako je tablična vrijednost *F*-testa, F_{-crit} = 2,445 manja od računske F = 9,0499, što znači da **stručna sprema**, odnosno radni zadaci koji su vezani za određenu stručnu spremu **bitno utiču na broj povreda.**

4.4. Broj povreda prema godinama radnog iskustva

Brojna istraživanja su pokazala da se na istovrsnim poslovima i u jednakim uslovima rada, mlađi radnici se češće povređuju, a da su povrede starijih radnika teže prirode. Uz to, podaci o povredama na radu prema dužini radnog staža povređenih radnika pokazuju koje se kategorije radnika, u odnosu na dužinu radnog staža, povređuju više, a koje manje.

Istraživanja provedena u [2], na dvije firme u Centralnoj Srbiji, o povredama na radu prema dužini radnog staža povređenih radnika ukazuju da se u preduzeću „Polet" a.d. najčešće povređuju radnici sa manjim radnim stažom (do jedne godine radnog staža čak 28,5% i od jedne do pet godina- 31,8 %), do pet godina, jer na njih otpada čak 59,3 % svih povreda na radu. Radnici sa dužim radnim stažom preko deset godina znatni se manje povređuju (13,4 %)

Podaci o povredama na radu prema dužini radnog staža povređenih radnika u "Carnex" a.d. pokazuju da se najčešće povređuju radnici sa manjim radnim stažom (dve godine radnog staža 5,87 % i sa 20 godina 5,87 % svih povreda na radu. Radnici sa radnim stažom od 25 godina takođe se značajno povređuju (5,68 %).

Podaci iz Tabele 9 i 10 daju pregled povreda i frekvenciju povreda prema datim grupama radnog iskustva u godinama za posmatrani vremenski period 2013-2017. godina. Iz ovih podataka, vidljivo je da 50% povreda odnosi se na uposlenike sa radnim iskustvom od 1 – 3 godine.

Table 8 is a joint table for analyzing variance of a one-factor experiment plan. As the F-test datum value, F-crit = 2,445 is smaller than compute F = 9,0499, which means that **vocational qualifications** or work assignments related to a particular qualification have **a significant impact on the number of injuries**.

4.4. Number of injuries by years of working experience

Numerous studies have shown that, in similar jobs and in equal working conditions, younger workers are more likely to be injured and that older workers' injuries are of a more serious nature. In addition, data on injuries to work according to the length of working time of injured workers indicate which categories of workers, in terms of length of service, affect more, and less.

Studies conducted in [2], on two companies in Central Serbia, about injuries at work according to the length of working experience of injured workers indicate that in the company "Polet" a.d. most often there are injured workers with a lower working life (up to one year of work experience up to 28.5% and one to five years - 31.8%), up to five years, as they account for as much as 59.3% of all injuries at work. Workers with longer working lives for more than ten years are significantly less affected (13.4%)

Data on injuries at work according to the length of working time of injured workers in "Carnex" a.d. indicate that workers with less working time (two years of work experience 5.87% and with 20 years of age 5.87% of all injuries at work are most often violated.) Workers with 25 years of work also significantly injure (5.68%).

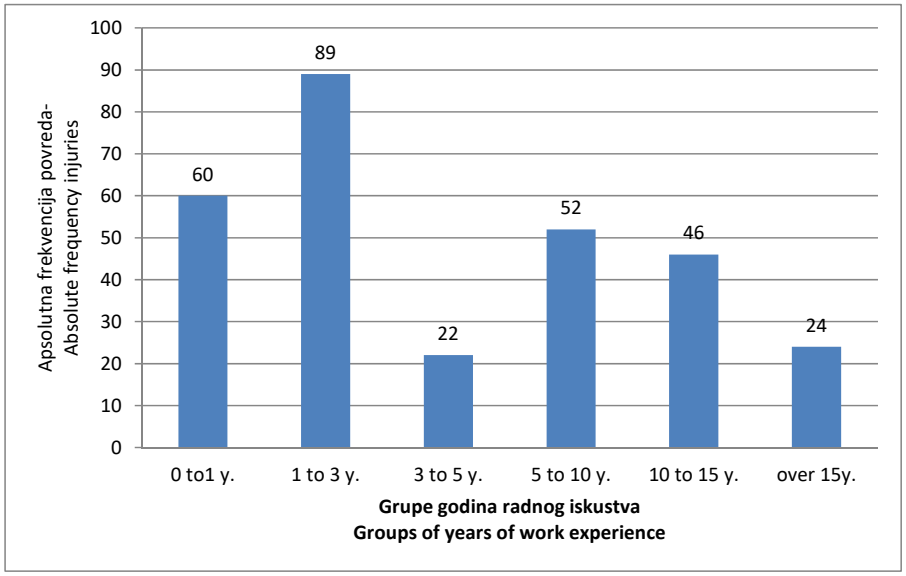
The data from Tables 9 and 10 provide an overview of injuries and frequency of injuries according to the given work experience groups over the years for the observed period 2013-2017. From these data, it is apparent that 50% of injuries refer to employees with 1 to 3 years of work experience.

Tabela 9. *Pregled povreda u 2013-2017. god. po datim grupama godina radnog iskustva [5]*
Table 9. *Overview of injuries in 2013-2017 by given groups of years of work experience [5]*

Radno iskustvo Work experience / Godina-Year	0 to 1 year	1 to 3 years	3 to 5 years	5 to 10 years	10 to 15 years	Over 15 years	Total ∑
2013.	1	1	7	10	7	3	29
2014.	11	1	5	17	8	6	48
2015.	6	8	0	10	8	8	40
2016.	26	41	4	10	10	3	94
2017.	16	38	6	5	13	4	82
Ukupno - Overall ∑	60	89	22	52	46	24	293
Prosječna vrijednost Average value	12	17,8	4,4	10,4	9,2	4,8	58,6

Tabela 10. Frekvencija povreda prema datim grupama godina radnog iskustva na osnovu podataka iz Tabele 9 u posmatranom periodu 2013-2017. godina
Table 10. Frequency of injury to given groups of years of work experience based on data from Table 9 in the observed period 2013-2017

Radno iskustvo Working experience	Apsolutna frekvencija Absolute frequency	Kumulativna Cumulative	Relativna frekvencija Relative frequency	Relativna frek. x 100% Relative freq. x100%	Kumulativna Cumulative
0 to 1 year	60	60	0,2	20	20
1 to 3 years	89	149	0,3	30	50
3 to 5 years	22	171	0,075	7,5	57,5
5 to 10 years	52	223	0,18	18	75,5
10 to 15 years	46	269	0,16	16	91,5
Over 15 years	24	293	0,08	8	100
Overall	293		1	100	



Slika 5. *Ukupan broj povreda prema godinama radnog iskustva za period 2013-2017. godina [5]*
Picture 5. *Total number of injuries by years of work experience for the period 2013-2017 [5]*

Na slici 5. da je histogram frekvencija povreda prema podacima iz Tabele 9.
Tabele 11. i 12. daju pregled rezultata analize varijanse prema podacima iz Tabele 9. Na osnovu vrijednosti za F-tablično F-testa (F_{crit}=2,62 veće od F-računsko F=1,4) možemo zaključiti da ovako date grupe **radnog iskustva u godinama, bitno ne utiču na broj povreda**. Ukoliko bi se prve tri grupe svrstale u jednu (0-5 godina iskustva) onda bi taj procenat bio 57,5% i to bi bio znatan uticaj.

Picture 5 presents the histogram of the frequency of injury according to the data in Table 9.
Tables 11 and 12 give an overview of the variance analysis results according to the data from Table 9. Based on the value for the F-table F-test (F-crit = 2,62 greater than F-compute F = 1,4) we can conclude that such given groups of **working experience in years, does not significantly affect the number of injuries**. If the first three groups were grouped into one (0-5 years of experience), then that percentage would be 57.5% and this would have a significant impact.

Tabela 11. *Rezultati proračuna za podatke iz Tabele 9.*
Table 11. *The results of calculation for tha dana from Table 9.*

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
0 to1 year	5	60	12	92,5
1 to 3 years	5	89	17,8	401,7
3 to 5 years	5	22	4,4	7,3
5 to 10 years	5	52	10,4	18,3
10 to 15 years	5	46	9,2	5,7
Over 15 years	5	24	4,8	4,7

Tabela 12. *Rezultati analize varijanse za podatke iz Tabele 9.*
Table 12. *The results of analysis of variance for the data from Table 9.*

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	618,5667	5	123,7133	1,4	0,259762	2,620654
Within Groups	2120,8	24	88,36667			
Total	2739,367	29				

5. ZAKLJUČAK

Iz date analize podataka o broju povreda prema podacima koji su sortirani prema godišnjim izvještajima službe zaštite rudnika, može se zaključiti sljedeće:

- od svih podataka, samo podaci o broju povreda vezanih za kvalifikacionu strukturu uposlenika i mjestu nastanka povrede upućuju na zaključak da kvalifikaciona struktura (radni zadaci vezani za određene kvalifikacije) i radni zadaci vezani za određena radilišta (mjesto nastanka povrede), bitno utiču na broj povreda,
- ovi podaci mogu poslužiti za kvalitetnu analizu povreda i donošenje potrebnih mjera i aktivnosti koje treba sprovesti kako bi se smanjio broj povreda i povećala sigurnost uposlenika,

5. CONCLUSIONS

From the data analysis of the number of injuries to the data compiled according to the annual reports of the mine protection service, it can be concluded that:

- From all the data, only the data on the number of injuries related to the qualification structure of the staff and the origin of the injunction indicate that the qualification structure (work assignments related to certain qualifications) and work assignments related to the particular work site (place of injury) have a significant impact on the number violation,
- These data can serve to provide a good analysis of injuries and to take the necessary measures and activities to be implemented in order to reduce the number of injuries and increase the safety of employees,

- ovo se posebno odnosi na izradu i održavanje transportnih i drugih putova, instalisanje postrojenja i opreme u njima u skladu sa zakon i obaveznim pravilima za rudarstvo sa podzemnom eksploatacijom što bi sigurno povećalo sigurnost uposlenika i smanjilo broj povreda,
- bilo bi zanimljivo napravit stanje sa visinom novčanih sredstava koje rudnik izdvaja na godišnjem nivo za odštete uposlenicima kao i sa direktnim troškovima bolovanja koje izazivaju povrede,
- ostali navedeni i analizirani podaci mogu poslužiti za preduzimanje potrebnih mjera samo na određene grupe uposlenika i određene radne zadatke koje bi parcijalno povećale sigurnost i smanjile broj povreda prema tim grupama uposlenika i grupama radnih zadataka;
- na osnovu prikazanog donijeti mjere obuke za sigurnost na radu, naročito za one koji tek počinju raditi na rudniku.

- This is particularly true for the construction and maintenance of transport and other roads, the installation of facilities and equipment therein, in accordance with the law and the mandatory rules for mining with underground exploitation, which would surely increase the safety of employees and reduce the number of injuries,
- It would be interesting to make a situation with the amount of money that the mine allocates on an annual level for employee compensation as well as the direct costs of sickness that cause injury,
- The other listed and analyzed data can serve to take the necessary measures only to certain groups of employees and certain work tasks that would partially increase security and reduce the number of injuries to these groups of employees and work task groups;
- Based on the above, we need to adopt measures for safety at work, especially for those who are just starting to work on the coal mine.

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[5] *Dokumentacija ZD RMU „Abid Lolić“ Bila-Travnik,*

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