sciendo

ASSESSMENT OF WOOD PROCESSING SAFETY IN THE PRODUCTION ORGANIZATION

doi:10.2478/mape-2018-0092
Date of submission of the article to the Editor: 05/2018
Date of acceptance of the article by the Editor: 07/2018
MAPE 2018, volume 1, issue 1, pp. 727-737

Doc. Ing. Martin Kotus, PhD.
Krištof Koloman
Matej Hudec
Slovak University of Agriculture in Nitra, **Slovak Republic**

Abstract: Occupational health and safety legislation imposes an obligation on the production organization to regularly and comprehensibly inform employees of the dangers, threats and risks involved. In the paper, we assessed the basic requirements of safety in the wood processing workshop on the forming disc saw. Deficiencies in non-compliance with security regulations were determined from the check list analysis (CLA). The safety assessment was performed using the extended point method, where we determined the value of the risk measure. When working on a saw blade, the risk cannot be accepted and safety precautions have to be proposed. For the production organization, we have proposed remedial measures and a safety card to be considered before working on forming disc saw. All the measures proposed by us were accepted and implemented by the production organization. Applying and observing safety measures can prevent the occurrence of an occupational injury or damage to the health of the worker.

Keywords: hazard, threat, risk, circular saw

1. INTRODUCTION

Current European legislation sets out the general principles of prevention and basic conditions to ensure occupational safety and health (OHS) and to eliminate the risks and factors that make work injuries and other health hazards worse. For the safety of machines it is Directive 2006/42/EC on the approximation of the laws of the member states relating to machinery.

With this directive, the machinery manufacturer is required to eliminate or minimize the hazards (risks), to propose measures to control the risks (threats) that can be removed. Furthermore, he is obliged to inform the user of the residual threats machine and design the machine so that even in the event of its malfunctioning, risks will not occur during its operation. (Šolc, 2013).

The safety risks of accidents in process plants usually are managed with some form of risk assessment. Similarly, the security risks of male vents, that is deliberate actions to cause harm, also are managed with risk assessment. However, security risks differ in various ways from safety risks and security risk assessment poses special challenges. Current methods for security risk assessment in the process industries use approaches that are seriously flawed. This includes methods incorporated into several industry standards that employ risk scoring methods such as risk matrices (Baybutt, 2017; Dziuba et al., 2016).

The requirements for analysing the hazards, risks and threats posed to machine manufacturers as well as their users do not prescribe which methods to use. The choice of procedures and methods is left to their discretion. Risk assessment can be done in different forms. What form we choose depends on the information received, the judgment of the assessors, but also on the purpose of assessing the risks, the type of threats, etc. These include qualitative or quantitative assessments, or combinations thereof. Of course, it is also necessary to take into account the production organization and production process. (Matisková, 2013a; Pačaiová et al., 2016a).

The internationally recognized specification OHSAS 18001:2007 sets out the requirements for a health and safety management system to enable the organization to manage risks and

improve performance. The forthcoming ISO 45001:2018 standard represents, among other changes, a more explicit solution to risks and opportunities. Requirements for the identification of risk sources are defined in more detail, with an emphasis on a proactive approach to risk identification.

Risk assessment is the process of assessing the risks to the health and safety of employees resulting from workplace hazards. It is a systematic review of all aspects of the work. In particular, what could cause injury or harm to the risk, and if that is not possible, what preventive or protective measures were taken (or should be taken) at the workplace to control the risk. (Ingaldi and Dziuba, 2017; Matisková, 2013b).

The level of reliability of an employee in a work environment depends on his/her physical characteristics, psychological dignity and level of knowledge. Risk assessment must include the full range of human errors – from sketch of formal errors, through tension, fatigue, to incorrect risk assessment techniques, and the like. A human error can be defined as a failure to perform a specified task (or executing a prohibited activity), which may be the cause of a device malfunction or a disruption of the normal operation of scheduled operations. (Burda et al., 2010; Pačaiová et al., 2016b).

For years, professionals involved in the investigation of industrial accidents have identified "human error" as a common cause of many major process safety incidents. However, incorrect actions by workers that lead or contribute to disaster are associated with factors related to cultural, engineering, situational, psychological, procedural, and organizational aspects, and tend to remain in the background (Alonso and Broadribb, 2018; Ťavodová and Sujová, 2005).

The aim of the contribution is to assess the safety and health of employees in the production organization dealing with the processing of wood. In a wood processing workshop, we identify the dangers and health hazards of employees when working on a formatting disk saw. We will then assess and measure the risk by applying the extended point method. On the basis of the risk assessment, we will propose security measures to reduce the risk to the health of employees.

2. MATERIAL AND METHODS

We assess the safety of wood processing in the production organization STOLÁRSTVO HUDEC s.r.o. established in Vieska nad Žitavou, Slovak Republic. The manufacturing organization has long been specializing in the production of furniture, shelters, gazebos and various custom wood products. These products are made of solid wood or chipboard in various colours.

As a machine safety examination we have selected machine PK 315A type circular saw (Fig.1). The circular saw is one of the most widespread devices for mechanical woodcutting. Selected circular saw have in the wood processing workshop an important functions in the form of very precise cutting of materials and the creation of transverse or sloping cuts with manual workpiece displacement.

Fig. 1. Formatting circular saw PK 315A

With this saw, it is possible to make cuts of different types of wood materials (wood mass, wood and wood-based laminates, chipboard) and easily cut logs. Part of the formatting saw is a sliding table that is close to the saw blade. The height and tilt of the saw blades can be easily adjusted.
Main parameters of circular saw are following:

- Engine power 3.7 kW,
- Engine speed 2 865/min.,
- Maximum diameter of saw blade 315 mm,
- Saw blade speed 3 755/min.,
- Maximum height/width/length of cut 100/1050/2000 mm,
- Weight 455 kg.

We use the Check List Analysis (CLA) to identify hazards and threats. Checklists are often used to check compliance with requirements and standards. The check-list of question and answer was developed for the circular saw by machine operator, the technical and safety status of the equipment and the working environment of the workshop.
We will use the extended point method to analyse and assess the risks involved in operating the circular saw. The risk (R) is the product of three parameters, namely the occurrence of the event (P), the result of the event (D) and the opinion of the evaluator (V). We define the risk estimate according to the point assessment in Table 1. We will classify the resulting risk measure into the five categories (KR) listed in Table 2.
Event probability (P) determines the probability of occurrence of an adverse event. The consequence of the event (D) is the severity of the occurrence of the undesirable event. The evaluator's opinion (V) includes consideration of the level of management, time of action, threats, staff qualifications, working ethics, level of prevention, status and age of technical equipment, level of maintenance, impact of work environment, workshop displacement, etc.

Table 1
Score of risk assessment

P – event probability		D – severity of the consequence		V – evaluator's opinion	
Word classification	**Score**	**Word classification**	**Score**	**Word classification**	**Score**
Unlikely	1	Damage to work ability and health	1	Negligible influence	1
Random	2	Injury with work incapacity	2	Little influence	2
Probable	3	More serious injury requiring hospitalization	3	Notable impact	3
Very likely	4	Severe work injury with lasting consequences	4	Great influence, significant	4
Permanent	5	Fatal accident	5	More significant impacts	5

Table 2
Determination of the risk category

R - risk	Category of risk (KR)	Score range	Assessment of security	Need for security measures
negligible	I.	1-4	Security is acceptable	Measures are not necessary
slightly	II.	5-10	The risk is acceptable with increased attention	The system is safe, the possibility of improvement
worrying	III.	11-50	Without protective measures, the risk can not be accepted	Measures are needed
undesirable	IV.	51-100	Safety is unsuitable, great, possibility of injury	Need to take immediate action, with a short deadline
unacceptable	V.	101-125	The system is dangerous, a great possibility of injury	Immediate stop of activity, decommissioning

3. RESULTS

To identify hazards and machine hazards the CLA analysis was used. The list of questions was created in cooperation with the head of change and safety technicians in the production organization. Answering questions were done workers which are working specifically with the selected circular saw.

On the basis of the control records, we have identified possible dangers and threats to the health of workers. In Table 3, we present the list of hazards and threats that may occur when working on a formatting circular saw. Then we also present risk assessment using an extended point method.

Table 3
List of hazards and threats, risk level

HAZARDS	THREATS	P	D	V	R	KR
excessive machine noise	hearing impairment of a worker	4	1	4	**16**	**III.**
	disturbance of worker's concentration	2	1	4	**8**	**II.**
	fatigue of a worker	2	1	4	**8**	**II.**
excessive noise of surrounding machines	hearing impairment of a worker	4	1	4	**16**	**III.**
	disturbance of worker's concentration	2	1	4	**8**	**II.**
	fatigue of a worker	2	1	4	**8**	**II.**
sharpness of saw blade	sectioning of the upper limb	3	3	5	**45**	**III.**
	cutting off a portion of the upper limb	3	4	5	**60**	**IV.**
rotating high-speed saw blade	grabbing, pulling, wringing of the working clothes of the operator	2	3	4	**24**	**III.**
	coughing of the upper limbs	2	4	4	**32**	**III.**
damage of the saw blade	hit by saw blade fragments or thrown material	1	3	3	**9**	**II.**
	the formation of sparks and flame, fire	2	1	2	**4**	**I.**
flying particles from materials (sawdust, chips, dust, cuttings)	operator hit by the particles	3	1	4	**12**	**III.**
	the penetration of the particle into the eye	2	1	4	**8**	**II.**
workpiece kickback	punching, stabbing, and picking up the material into the operator by machine	2	2	4	**16**	**III.**
present dangerous flammable wood dust and sawdust	respiratory tract irritation, allergy	2	2	4	**8**	**II.**
	poisoning, suffocation	1	5	4	**20**	**III.**
	explosion	1	5	4	**20**	**III.**
lack of daylight	eye damage	3	1	4	**12**	**III.**
	worse worker concentration	3	1	4	**12**	**III.**
	visual fatigue of the worker	2	1	4	**8**	**II.**
obstacles and dirt on the floor around the machine	fall, clogging a worker on waste material on the floor near the machine	3	1	4	**12**	**III.**
	slipping the worker on the floor	2	1	4	**8**	**II.**
sawing large size materials	fall, prevalence, overthrowing	2	1	3	**6**	**II.**
	pressing, pressing of the operator	2	2	3	**12**	**III.**
electric current	electrical tripping and electric shock	2	5	3	**30**	**III.**

Found deficiencies in the operation of the machine:

- The worker does not perform regular machine inspections before each work on the machine.
- Protective equipment were assigned to workers, but the worker does not use them regularly.

- The worker does not use sliding work means designed to move narrow and tiny material towards the saw blade.
- After completing the work, the worker does not leave the workplace until the saw blade has completely stopped.
- The operator does not keep all parts of the machine and the workspace always clean and does not clean the machine and machine workspace regularly.
- The worker does not use the suction device while driving the machine.
- The worker does not use blades designed to reduce the noise level.

Found deficiencies in the technical and safety status of the machine:

- Large-sized workpieces are not always sufficiently secured against overturning, tilting, or falling during machine cutting.
- There is no manual for the machine in reach of operator.
- There is no protective cover on the main saw blade.
- The use of personal protective equipment on the machine or in its vicinity does not show the use of the worker in the course of work.
- A suction device is attached to the machine and does not remove all the particles. At the point of origin of the cut with the saw blade, particles (dust, sawdust, chips and pollutants) which are not directly exhausted at their origin are created, as there is no suction hose at the saw blade leading to the main suction device which is attached to the saw blade guard roll.
- The machine's working table is not cleaned and kept out of the waste material and polluted regularly after work.
- There is no cutting wedge behind the saw blade, which is designed to prevent backing material.

Found deficiencies in the work environment of the machine:

- There are a number of machines in the workshop that cause increased noise and their noise is likely to exceed the lower exposure action value.
- The machine's work area and access path to the machine are not sufficiently marked.
- Daily (on-site) lighting in the workplace is not always sufficient, as other objects in the form of material interfere with the daily lighting of the machine.
- Unevenness, waste material and other obstructions are not regularly removed from the floor around the machine.
- The power line is protruding from the floor and is not sufficiently separated from the operator's access to the machine during work on the machine.

The examples of deficiencies found are shown in the following Fig. 2 to Fig.4

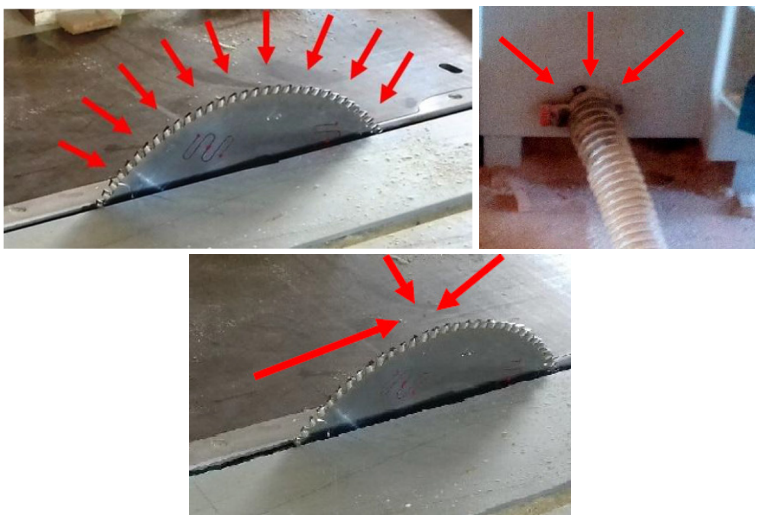

Fig. 2. Missing protective cover, mains connection of suction hose, missing suction hose

Fig. 3. Machine working table with waste material, missing splintering wedge, material in the place of windows.

Fig. 4. Waste material and obstacles on the floor near the machine

The production organization is required to provide every employee with regular, understandable and demonstrable instructions related to the principles of safe work, health and safety at work, principles of safe workplace behaviour and safe working practices and to verify their knowledge. Furthermore, the production organization is obliged to inform every employee of the existing and foreseeable dangers and threats, with the possible impacts they may have on health and the protection against them.

Based on these production organization's responsibilities, we have come up with a proposal for corrective safety measures. The deficiencies found by us increase the health of the worker at the machine. The revealed deficiencies are also the increased value of risk. The risk of working on the saw blade can be defined as moderate to pervasive. Only one case (cut off a part of the limb) is undesirable and immediate corrective action is needed. We need to reduce the calculated level of risk to an acceptable level. Applying and observing safety measures can prevent the occurrence of an occupational injury or damage to the health of the worker.

For the production organization, we proposed to apply these security measures:

- On the saw blade, it is necessary to install a protective cover that protects the machine worker from touching the rotating saw blade, before flying particles of the cut material or before the blade has been ejected from the work tool.
- Be sure to install a cutting wedge behind the saw blade that protects the machine operator from the back of the machined material.
- The saw blade needs to be equipped with a suction attachment, through which the suction hose of the device sucks directly from the cutting location all the particles in the form of dust, sawdust, chips and small cuttings.

Fig. 5. The guard wedge (A), the split wedge (B) and the suction head (C)

- The electrical line that protrudes from the floor and leads to the formatting saw must be covered and stripped so that the operator does not have access to this power line when operating the machine.
- To reduce the noise level on the saw blade, it is necessary to use exclusively saw blades with specific blades designed to reduce the noise level.
- Removing stored and stamped material at the location of windows, due to the daylight entering the machine's workspace.
- Label the workspace and access path to the machine.
- Place the saw's operating instructions close to the machine so that it is always available to the machine operator.
- Develop a safety manual for the machine operator, with its location on the machine or in a visible place around the machine.
- Providing and observing the use of personal protective equipment for the worker on the machine.
- Use of sliding workpieces for every cutting of small and narrow materials. These devices prevent contact between the operator's upper limbs and the saw blade.

In addition to the aforementioned security suggestions, we also propose regular staff training. Unannounced inspections of workers when using the saw are also required.

In order to protect the health of the worker and increase the safety of the saw blade, it is also necessary to focus on:

- performing regular machine inspections before each work activity, namely:
  - any possible damage to the machine,
  - correct selection of the saw blade according to the cutting material,
  - correct clamping, tightening and saw blade condition,
  - correct connection of the suction device,
  - the correct setting of the protective cover and the splitting wedge,
  - cleanliness of the machine and working environment around the machine,
- regular cleaning of the machine and working space in the vicinity of the machine from the generated waste material after each work on the machine,
- use of the suction device regularly during each work on the machine,
- leaving the post after completing work until the saw blade has been completely stopped,
- sufficient provision of large-scale workpieces against overturning, tilting or falling or calling auxiliary servicing,
- the regular use of the personal protective equipment during each work on formatting circular saw, that is:
  - eyeglasses that are designed to protect the eyes from flying particles of machined material,
  - hearing aids or ear-muffs designed to protect the worker's hearing from noise,
  - respirator or protective veil designed to protect worker's respiratory tract,
  - protective footwear with a protective toe and an anti-slip shoe that is designed to prevent material from falling on the lower extremities of the worker and against slipping on the uncleaned floor around the machine,

  - a reinforced protective apron which is designed to prevent the material from returning to the body of the operator,
- excluding loose clothing, rings, bracelets, watches, neckties, long hair, loose hair, loose sleeves to engage in a rotating saw blade.
- a ban on working under the influence of alcohol, drugs, and a strict smoking ban throughout the workshop.

To work with a saw blade, we recommend creating a safety card (fig. 6), which serves as a guide to the prevention of occupational injuries. This will include safety rules when working with a saw blade to which the worker may not forget. Also, there may be instructions related to the duties for the worker to increase his / her safety, use of personal safety equipment. The security card will be legible and comprehensible, and its location must be close to the machine in a visible location for the worker.

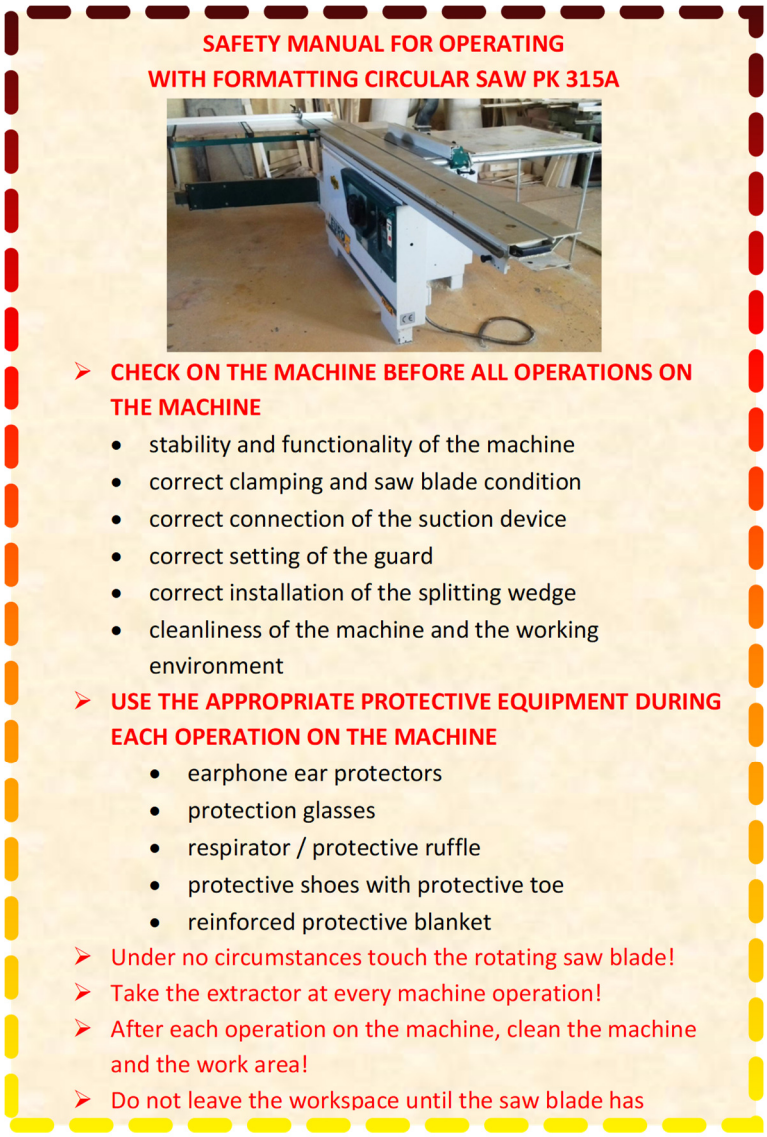

Fig. 6. Safety card for work on the saw blade

OHSAS 18001 is an internationally recognized specification for the assessment of OHSAS management systems. It was developed in response to the urgent requirement of organizations that their OHSAS management systems could be assessed and certified. The underlying principle is to identify all possible risks in the workplaces and to manage them effectively so as to minimize potential damage to the health of employees - the consequences.

ISO 45001 is the new international standard for occupational health and safety management, replacing the OHSAS 18001 management system. The purpose of the new standard is to harmonize with national standards to reduce ambiguous requirements and increase consistency. This management system allows you to control the risks to work safety and health at work, improve business safety and create a safe environment for both workers and suppliers.

The philosophy of risk assessment is based on the principle that it is not possible to achieve safety at the workplace only by complying with the OHSAS provisions. It is necessary to consider OHSAS, beyond the rules, what can harm people. The principle is that there is no zero risk, there is no absolute safety. Security can only be understood as accepting a degree of risk. Such knowledge places demands on people, constantly paying attention. Know the dangers that can cause injury and know how to protect them. (Kredatusová and Bujna, 2010; Baron et al., 2014).

Human factor is an integral part of technical systems and technological processes, its share in controlling these systems is often quite large. Reliability of the "man-machine" system depends mainly on the reliability of the person. Reliability of a human factor is usually defined as the likelihood that a person will properly perform a certain activity during the tent time without conducting any side activities that could affect the reliability of the entire system. (Kardas, 2016; Pačaiová et al., 2016)

Human factors and cognitive engineering are considered nowadays as important multidisciplinary domains that focus on improving the relations between humans, technology and systems to be supervised and operated. The industrial automation and control systems (IACS) in hazardous plants are increasingly computerized and perform various safety functions. These are usually designed and implemented according to the functional safety requirements (Kosmowski, 2018; Kardas, 2017).

In general, it is possible to define the dependency between the reliability of a person and the elements (internal and external influences) that affect it. Internal influences are the basic characteristic of individual circumstances. Internal influences include motivation, mental and mental ability, temperament, concentration, reaction rate and knowledge. External impacts are a set of influences on the environment in which the worker performs the activity. External influences include physical (workplace quality), organizational (workplace interactions) and personal factors (physical and mental health). (Dado et al., 2013; Ingaldi and Dziuba, 2017)

The paper describes work activities and the resulting dangers and threats to the health of employees. We have also defined organizational, technical and individual protection measures in the design of security measures. These precautions are used to eliminate or minimize the risks involved. However, it is important for every worker to have a perceived risk perception. He must be able to use it to recognize what can cause an injury or an unpleasant situation. It must also lead to such colleagues' approach.

There exist a number of definitions of the concept of risk. Very few of them directly express how exposure and risk exposure are connected to the risk. Clearly there is a connection, but it is not evident how these concepts are related (Aven, 2012; Pauliček et al., 2012).

Each production organization is required to identify hazards and threats, to assess risk and to prepare a written risk assessment document for all activities performed by employees. The production organization must eliminate the hazards and threats and, if scientific and technical knowledge is not possible, take measures to limit them and prepare measures to eliminate them. (Markulík et al., 2016; Šolc et al., 2017)

Ultimate responsibility for risk management is borne by employers and senior management, but their efforts cannot be successful without the active involvement of employees. Managers have to adopt modern trends in health and safety at work, and must be an example in their activities. Their role is to influence OHSAS enforcement through information, communication and training as well as through rigorous control.

Risk assessment is the key to managing workplace health and safety. The risk of work is to express the likelihood and severity of the injury or disease by the danger. Risk assessment provides the basis for successful management of health and safety at work in the manufacturing organization. A properly conducted assessment can increase workplace safety and improve health as well as overall work performance. (Dado et al., 2011; Ťavodová, 2010)

4. CONCLUSIONS

Products and work procedures intended for use at work must comply with the requirements of the legislation and other regulations to ensure safety and health at work. This includes assessing the unavoidable hazards and unavoidable risks that result from proposed solutions under specified operating and user conditions, assessing the risk of their use, and proposing safeguards against these dangers and threats.

Work is so diverse and complex that a systematic analysis is needed to identify hazards and threats. Such a process can also be called risk assessment. The main objective of risk assessment at work is to protect the health and safety of employees. Risk assessment helps minimize potential damage to employees or the environment caused by work.

In the paper, we pointed out the dangers and health hazards of workers that may occur in the workplace. Of all the machines in the joinery workshop, we chose a machine with high accident probability. By defining the degree of risk and the subsequent categorization of risks using the extended point method, we have proposed safety measures. After analysing the shortcomings, we found the necessity to design safety measures when operating the circular saw.

These safety rules have a practical use in a particular joinery workshop. All the safety measures and recommendations proposed by us have been accepted by the manufacturing organization. We expect that, while adhering to these rules, it is possible to create an appropriate occupational health and safety environment for all workers. We must not forget that the occupational safety assessment is a continuous activity necessary to protect the health of employees.

ACKNOWLEDGEMENT

The contribution is an output of the project KEGA No.008TU Z-4/2016 entitled „New forms and methods of the education in the field of security of machinery“.

REFERENCES

Alonso, I.J. and Broadribb, M. (2018). Human error: A myth eclipsing real causes. Process Safety Progress, Volume 37(2). pp. 145-149.

Aven, T. (2012). On the link between risk and exposure. Reliability Engineering and System safety. Volume 103. pp. 191-199.

Baybutt, P. (2017). Issues for security risk assessment in the process industries. Journal of Loss Prevention in the Process Industries, Volume 49. pp 509-518.

Baron, P., Šoltésová, S. and Kočiško, M. (2014). The development of a knowledge based system for the process of risk assessment in the workplace. Applied Mechanics and Materials, Volume 446-447, Beijing : China; 2013. pp. 1314-1320.

Bujna, M., Kotus, M. and Čičo, P. (2017). Manažérstvo rizika. (Risk Management). Nitra : SUA. pp.220.

Burda, M., Čičo, P. and Bujna, M. (2010). Posúdenie rizika, pracovného miesta komplexnou metódou. Kvalita a spoľahlivosť technických systémov. (Risk assessment of work place by comprehensive method. Quality and reliability of technical systems). Nitra : SUA. pp. 61-65.

Dado, M, Hnilica, R., Kováč, J. and Kučera, M. (2011). Assessment of hand-transmitted vibration during work with chain saw. Annals of DAAAM for 2011 & proceedings of the 22nd international DAAAM symposium "Intelligent manufacturing & automation: power of knowledge and creativity". Vienna : DAAAM International Vienna. pp. 1083-1084.

Dado, M, Hnilica, R. and Schwarz, M. (2013). Development of virtual laboratory for evaluation and control of workplace hazards. Engineering for rural development : 12th international scientific conference. Jelgava: Latvia University of Agriculture, pp. 573-576.

Dado, M., Němec, M. and Hnilica, R. (2013). Evaluation of acoustic suitability of woodworking shop based on spatial sound distribution curves measurements. Akustika: odborný časopis o akustice a vibracích. Vol. 20 (2). pp. 6-9.

Dziuba, S., Ingaldi, M. and Kadłubek, M. (2016). Use of Quality Management Tools for Evaluation of the Products' Quality in Global Economy. Globalization And Its Socio-Economic Consequences : 16th International Scientific Conference Proceedings. Žilina : University of Zilina. pp. 425-432.

Ingaldi, M. and Dziuba, S.T. (2016). Supervisor's Assessment as an Element Effecting Technological Process in Chosen Metallurgical Company. 25th Anniversary International Conference on Metallurgy and Materials. Ostrava : Tanger Ltd., pp. 1822-1828.

Ingaldi, M. and Dziuba, S.T. (2017) Popularity of environment management system according to iso 14001 in Poland. International Multidisciplinary Scientific GeoConference Surveying Geology and Mining Ecology Management. Volume 17 (53). pp. 611-618.

Kotus, M., Jankajová, E., Lestyánszka Škůrková, K., Matisková, D. and Zach, M. (2016). Safety Audit of Band Saw in Manufacturing Organization. Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis, Volume 64 (2). pp. 467-471.

Kredatusová, M. and Bujna, M. (2010). Identifikácia a analýza ohrozenia vo vybranom procese. Najnovšie trendy v poľnohospodárstve, v strojárstve a odpadovom hospodárstve. (Identification and analysis of the threats in selected process. New trends in agriculture, manufacturing and waste management) Nitra : SUA, 2010. pp.146-152.

Kosmowski, K.T. (2018). Human factors and cognitive engineering in functional safety analysis. Advances in Intelligent Systems and Computing, Volume 635. pp 434-448. 13th International Conference on Diagnostics of Processes and Systems, Sandomierz, Poland;

Markulík, Š., Kozel, R., Šolc, M. and Pačaiová. H., (2016). Causal dependence of events under management system conditions. MM Science Journal, Issue October, M Publishing Ltd., pp. 1040-1042.

Matisková, D. (2013). Požiadavky na systémy manažérstva kvality vo výrobných podnikoch. (Requirements on quality management systems in production companies). Posterus.sk. Volume 6 (7). pp. 1-7.

Matisková, D. (2013). Strategické plánovanie - základ kvality riadenia podniku. (Strategic planning – basics of quality management in company; Quality). Kvalita. Volume 21 (1). pp. 37-40.

OHSAS 18001:2007 / ISO 45001:2018. Systém manažérstva pre bezpečnosť práce a ochranu zdravia pri práci. (Management system for work safety and protection of health during work)

Pačaiová, H. et al. 2016. Metódy posudzovania rizík v rozhodovacích procesoch. (Risk evaluation methods in decision processes). Košice : SF TU, 2016. 330 s. ISBN978-80-553-3033-4.

Pačaiová, H. et al. 2016. Význam rizika v manažérskych systémoch. (Importance of risk in management systems). Košice : SF TU, 2016. 280 s. ISBN 978-80-553-2618-4.

Pauliček, T., Čičo, P., Zaujec, J. and Burda, M. (2012). Risk assessment and actions to reduction of risk in explosive environment. Management systems in production engineering. Vol. 2 (3) pp.18-20.

Šolc, M. (2013). Proces riadenia rizík projektov. Kvalita produkcie – od kvality k zodpovednosti a inováciám. (Process of project risk management. Production quality – from quality to responsibility and innovations). Herľany: HF TUKE. pp.107-111.

Šolc, M., Kliment, J., Girmanová, L., Sütoová, A. and Forrai, F. (2017). The system of transport dangerous goods by road transport. Transport Means - Proceedings of the International Conference. Kaunas : Kaunas University of Technology. pp. 1066-1071.

Ťavodová, M. 2010. Possibilities of using the control charts manufacture of wooden floor panels. In: Acta Facultatis Xylologiae. Volume 52, Issue 2, 2010. pp.111-119. ISSN 1336-3824.

Ťavodová, M. – Sujová, E. 2005. Vybrané rizikové faktory pracovného prostredia vznikajúce pri obrábaní dreva. Metódy ich identifikácie a hodnotenia. (Selected risk factors of work environment generated by wood processing. Methods of its identification and evaluation). In: Acta facultatis technicae. Volume 9, Issue 1, 2005. pp.7-18. ISSN 1336-4472.