Journal of Achievements in Materials and Manufacturing Engineering
VOLUME 51
ISSUE 2
April
2012

Occupational risk assessment at the work station in the selected enterprise

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Received 06.02.2011; published in revised form 01.04.2012

Industrial management and organisation

ABSTRACT

Purpose: In this paper the occupational risk assessment in the selected work stations in the company which operates in the mining industry was carried out. The legal requirements relating to work safety and occupational risk assessment were showed.
Design/methodology/approach: In this article three selected positions in the company were analysed and a comprehensive risk assessment was made for them. Appropriate actions and measures were proposed to reduce identified threats.
Findings: The threats analysis at the work stations was carried out. The cards of threats identification were the basis to risk estimation carried out. Moreover the risk acceptability criteria were proposed.
Research limitations/implications: The proper risk management in the enterprise assures the safety, financial stabilization and increase of efficiency and consciousness in the range of workers safety.
Practical implications: The cards of the risk assessment that were made for three work stations in the analysed organization making possible the introduction of preventive and corrective actions reducing possibility of occurrence of accidents and morbidity of employers on occupational diseases.
Originality/value: In this paper indicated that analysed enterprise takes care of own workers safety. After introduction of additional safety agents the occupational risk was reduced from high to low level which requires only preventive actions in the future.
Keywords: Safety and health management; Occupational risk assessment; Legal requirements of the occupational risk assessment; Card of the occupational risk assessment

Reference to this paper should be given in the following way:
A. Kania, M. Spilka, G. Cieśliński, Occupational risk assessment at the work station in the selected enterprise, Journal of Achievements in Materials and Manufacturing Engineering 51/2 (2012) 90-98.

1. Introduction

The "risk" notion derives from Italian language (risico). In general meaning the risk can be defined as "action that endangers something what has a value". The risk is often identifies with a threat or danger, with something that may stop an intentional aim achievement [1-3].

According to Polish dictionary the risk is defined as possibility of defeat, loss, undertaking which result is unreliable, doubtful.

In 1901 A.H. Willet affirmed that risk is something objective connected with subjective uncertainty.

In the thirties O. Lange defined risk as uncertainty able to quantifier.

In 2007 J. Bizon-Górecka presented the risk definition as: "risk for economic organizations needs is defined as a product of

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probability of event appearance and effects of its influence on processes in organization".

In relate to a man takes part in production process the risk means the occupational risk. The occupational risk is the probability of the emergence of detrimental incidents connected with the work conducted, resulting in losses, in particular the appearance of detrimental effects on health among workers as a result of occupational threats in the working environment or the method of performing work (Resolution of the Minister of Labour and Social Policy of 26 September 1997 on the general OSH regulations).

The occupational risk assessment belongs to duties that result from the legal regulations. It has to be carried out at every work station, especially [4, 5]:

- during creation of new work stations,
- during implementation of changes at the work stations,
- after changes of obligatory requirements, relating to estimated work stations,
- after changes in applied protection means.

2. Legal requirements of the occupational risk assessment

The Constitution of the Republic of Poland on 2 April 1997 is a basic legal act in Poland in the field of industrial safety (articles: 24, 66 and 68). The article 66 of the Constitution states that „everybody has the right to safe and healthy working conditions. The act defines the way of the realization of this right and the employer duties". The Labour Code is the act which defines the rights and duties of the citizens in this range [6].

The membership of Poland to the structures of the international organizations and accession to the structures of European Union, impose the duty of the adaptation of applicable provisions to the standards of the European law.

The Council Directive 89/391/EEC is the most important directive introduced to Polish legislation. It fulfils the part of the basic tool in the process of formation of the regulations from the range of the health and life protection of the workers. The most important legacies of this Directive concern [7]:

- the possible risk avoidance,
- risk estimation for which does not exist the possibility of a total elimination,
- organization of the work conditions, influence of factors occurring in the work environment,
- adaptation of a work to one man,
- applying the new technical solutions,
- risk at source prevention,
- replacing of a dangerous agents by new, safe,
- leadership of the coherent and general preventive politics,
- giving of the priority of collective protection measures before individual protection measures,
- proper instructing and workers training.

In 1991 resolutions of this Directive were introduced to the Labour Code.

The basic adjustments of the Labour Code in the range of industrial safety are following [6]:

- section X relating to the industrial safety,
- section VIII relating to the workers protection connected with parenthood,
- section IX relating to the work protection of the adolescents.

The regulatory acts of the safety referring to the resolutions of the section X of the Labour Code (general safety rules, branch safety rules and interbranch safety rules) issued on the basis of the delegation to the article 237 of the Labour Code are generally applicable provisions (Fig. 1). There are also acts relating to supervision and control of the work conditions and regulations relating to the different fields of the law, but regulating the industrial safety, for example Building Law, Geological and Mining Law and Atomic Law.

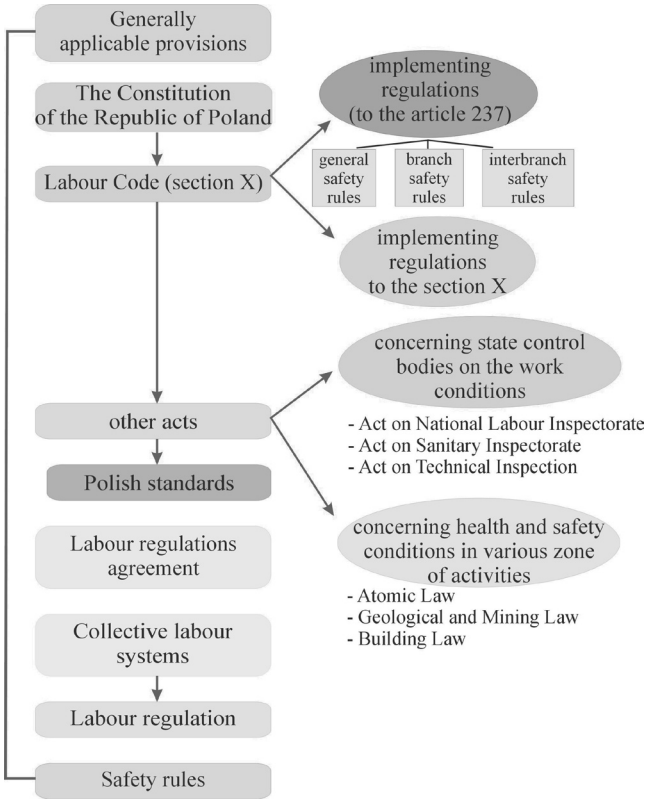

Fig. 1. Legal system in the occupational safety range in Poland [4]

To other regulations, being on the basis of the art. 9 of the Labour Code the work regulations, one should first of all number the collective labour systems.

The decisions of the collective labour systems, collective agreements, regulations and working places statutes they cannot be less favourable for the workers than the regulations of the Labour Code, and other acts and implementing regulations. To the regulations from the range of industrial safety one can number [4]:

- additional health privileges,
- additional leaves for work in harmful or burdensome conditions and shortening of the working time,
- financial compensations for workers employed in such conditions.

The labour regulation is an act regulating the matters from the range of industrial safety, specified in art. 104 of the Labour Code. It includes regulations relating to provision of workers in clothes, working shoes and individual protection or personal hygiene measures, specifications of forbidden work for adolescents workers and women.

Additionally the safety rules one should take into consideration.

3. Occupational risk assessment

The occupational risk assessment is a process of analysing and evaluation of a risk acceptability [8, 9]. This is a precise control and estimation of this what is harmful for workers at the work stations.

The employer makes the occupational risk assessment for all work stations (for all actions) in the enterprise [10]. This assessment is done in case of selection of the work station equipment, work places, applied substances and chemical, biological, carcinogenic preparations, before changing of a work organization at the work station, changing of requirements relating to acceptable level of the work environment factors, risk assessment, changes connected with the usage of protective measures.

One should take into consideration all the factors of the work environment occurring during performed actions and methods of these actions to the occupational risk assessment [1].

The methodology of the occupational risk assessment we can divide on two main areas [1, 8, 11]:

- the analysis of the occupational risk assessment which consists of:
  - collecting of necessary information for the occupational risk assessment carrying out,
  - identification of threats at the work stations,
  - estimation of the occupational risk,
- and its proper evaluation when the decision about acceptability (or not) of the estimated risk is taken. If the estimation is positive a periodical occupational risk assessment is recommended. Otherwise one should work out the suitable plan of correcting or preventive actions to the risk [12].

All above presented actions influence on the proper occupational risk management [13-15].

4. Occupational risk assessment in the chosen enterprise

The analysed enterprise specializes in delivery of the newest, innovative technologies, designing, production, implementation and serving of the hydraulic and electro-hydraulic systems of control and the automation of industrial processes connected with abyssal carbon output. The organization has in its offer all indispensable elements to the correct working of mining complexes in the coal-mines.

This enterprise does not produce large-size mining devices. It produces complete hydraulic and electro-hydraulic control systems assembled in mechanized mining casings, assuring them the possibilities of the physical motion. The organization offers complete pumper aggregates, automatic filters stations to hydraulic fluids, system of continuous control of the hydraulic fluids parameters named Recomatic and own hydraulic fluids.

4.1. Safety management in the analysed enterprise

The workers of this enterprise usage suitable tools and devices to carrying out of their duties. They have to have guaranteed safe for their health and life work stations. All the work stations were planned and prepared to fulfil their function the best. They are also monitored by regularly made environmental investigations by the proper environmental investigations laboratories.

The results of the investigations relating to lighting and noise show that the noise level on the studied work stations is lower than upper limits contained in the industrial safety regulations and the labour law. The peak levels exceeding upper limits occurred, however they didn't have the continuous character and they didn't influence on the results of the investigations. The measurements of lighting on the work stations showed in some cases a deficiency of illumination.

These discomforts were eliminated after investigations results obtaining by installation of the additional light sources.

The workers doing their work use many tools, beginning from the simplest, metal-work tools by electro tools indispensable during repair and maintenance. For these tools the workers don't have the additional certificates. They have necessary trainings in the industrial safety principles and they get acquainted with the station instructions.

In the enterprise there are devices for which possession of suitable authorizations are required according to the Labour Code. For these devices one can number machines and devices which inadequate use could result the loss of health by operating person or other person from surroundings and endanger the enterprise on material damages.

4.2. Occupational risk assessment at the work stations

The occupational risk assessment is made according to PN-N-18002:2000 standard [1, 11]. In this standard the risk valuation is made in three-stage scale (Table 1).

Table 1.
Estimation of the occupational risk – three-stage scale – PN-N-18002 [1, 11]

Probability of event causing threat	Frequency of consequence (effects)		
	Low	Medium	High
Probability low	low 1	low 1	medium 2
Probability	low 1	medium 2	high 3
Probability highly	medium 2	high 3	high 3

In dependence from a quantity of the evaluated risk an employer should apply the suitable preventive measures.

The occupational risk analysis is made for two work stations:

- storekeeper,
- hydraulics mining.

Occupational risk assessment at the work station of storekeeper

The person working in a store is responsible for:

- store work, record of stock on hand,
- storage, issuing, collection of goods,
- delivery of goods for customers,
- preserving order in a store.

The store accommodations are situated in a part of repair-production of the enterprise. One worker always spends in the store, however often come there other workers and suppliers. The person working in the store uses a computer, printing machine, telephone and means of transport.

The working time at this work station totals 8 hours daily. During the work 15 minutes break is included.

For this work station an identification of threats (Table 2) and the risk assessment card were worked out (Table 4).

Table 2.
Identification of threats at the storekeeper work station

threats	yes/no
Uneven or slippery areas (causing slip, fall, etc.)	yes
Moving means of transport	yes
Movable parts of machine	no
Sharp edges, rough	yes
Hot or cold surfaces, materials	no
Work at high altitude and movable platforms	yes
Hand tools	yes
Squeeze	yes
Electric current – electric shock	yes
Fire	yes
Explosion	yes
Chemical individuals in the air	yes
Noise	yes
Local vibration	no
Overall vibration	no
Immovable objects	yes
Abnormal lighting	yes
UV radiation, laser radiation, infrared radiation, microwaves	no
Electromagnetic fields	no
Hot or cold microclimate	no
Manual transport of weight	yes
Work in the uncomfortable or forced position	yes
Biological threats (viruses, parasites, bacteria, funguses)	no
Stress in the work	yes
Violence in the work	no
Communication accident	yes
Natural threats in the underground mining	no
Variable weather conditions	no

Occupational risk assessment at the hydraulics mining work station

The worker at the hydraulics mining work station is responsible for: assembly and disassembly work, metal-work work, grinding, lapping, transport of the elements, access to customer, work by customer in the mining conditions.

The workers of a service department move in the field of a whole working place and in the fields belong to customers – mainly coal-mines areas, on a mine head and underground.

The workers use all accessible manual tools and they very often use the means of transport.

The working time at this work station totals 8 hours daily. During the work 15 minutes break is included.

For this work station an identification of threats (Table 3) and the occupational risk assessment card were worked out (Table 5).

Table 3.
Identification of threats at the hydraulics mining work station

threats	yes/no
Uneven or slippery areas (causing slip, fall, etc.)	yes
Moving means of transport	yes
Movable parts of machine	yes
Sharp edges, rough	yes
Hot or cold surfaces, materials	yes
Work at high altitude and movable platforms (causing fall)	yes
Hand tools	yes
Squeeze	yes
Electric current – electric shock	yes
Fire	yes
Explosion	yes
Chemical individuals in the air	yes
Noise	yes
Local vibration	yes
Overall vibration	no
Immovable objects	yes
Abnormal lighting	yes
Ultraviolet radiation, laser radiation, infrared radiation, microwaves	no
Electromagnetic fields	no
Hot or cold microclimate	yes
Manual transport of weight	yes
Work in the uncomfortable or forced position	yes
Biological threats (viruses, parasites, bacteria, funguses)	no
Stress in the work	yes
Violence in the work	no
Communication accident	yes
Natural threats in the underground mining	yes
Variable weather conditions	yes

Table 4.
Card of the occupational risk assessment for the storekeeper work station according to the three-stage scale

No.	Threats	Threats source	Possible effects of a threat	Effect (E)	Probability (P)	Risk (R)	Risk acceptability
1	Fall at the same level.	Uneven and slippery areas leading to the store and in the store. Blocked passages.	Breaking limbs, concussion, inner injuries.	M	M	M	**acceptable**
2	Fall at the lower level.	Climbing on the ladders and coming down during packing or taking off products from shelves.	Breaking limbs, dislocations, spine injuries, concussion, inner injuries.	H	M	H	**unacceptable**
3	Squeeze. Stroke. Push.	Overturn of shelves, stored products. Inadequate material distribution.	Body injuries. Death.	H	M	H	**unacceptable**
4	Pricks. Injuries.	Sharply pointed edges of transported goods, pallets, packages, glass fragments.	Cut and stab wounds.	M	M	M	**acceptable**
5	Poisonings.	Combustion gases. Toxic compounds stored in the store.	Inner injuries of an organism.	M	M	M	**acceptable**
6	Noise.	Means of transport. Devices and machines working outside the store.	Injuries of an audition organ.	M	M	M	**acceptable**
7	Overload of the muscular-osseous system.	Large physical effort. Forced body position.	Rupture. Spine injuries. Movement organ diseases.	H	H	H	**unacceptable**
8	Incorrect lighting at the work station.	Inadequate natural lighting. Small number of the luminous points.	Injuries caused by the industrial accidents. Eyesight organ diseases.	H	L	M	**acceptable**
9	Electric shock.	Damaged electric conductors insulation. Contact with the conductive casings of machines. Devices under voltage.	Death. Burns.	H	L	M	**acceptable**
10	Fire. Explosion.	Start a fire.	Burn of the body. Injuries. Death.	H	M	H	**unacceptable**
11	Stress.	Financial responsible for the safety of stored goods. Interpersonal conflicts.	Nervous diseases. Inner organ diseases.	M	M	M	**acceptable**
12	Communication accident.	Usage of a business car. Public communication movement.	Invalidity. Injuries. Death.	H	M	H	**unacceptable**

Table 5.
Card of the occupational risk assessment for the hydraulics mining work station according to the three-stage scale

No.	Threats	Threats source	Possible effects of a threat	Effect (E)	Probability (P)	Risk (R)	Risk acceptability
1	Fall at the same level.	Surface in the working place are slippery and uneven.	Breaking limbs, concussion, inner injuries.	M	M	M	**acceptable**
2	Movement machines and devices. Chips of a stock.	Lack of the proper casings of movable elements of machines or devices. Lack or inadequate usage of working clothing and means of personal protection. Non-conformity to a station instruction.	Death. Serious body injuries.	H	H	H	**unacceptable**
3	Noise.	Machines, tools and electro tools usage in the enterprise.	Injuries of an audition organ.	H	H	H	**unacceptable**
4	Electric shock.	Damaged electric conductors insulation. Contact with the conductive casings of machines, tools and electro tools. Devices under voltage.	Death. Burns.	H	M	H	**unacceptable**
5	Objects stroke.	Manual tools, working elements. Assembly or disassembly devices or constructions.	Breaking limbs, dislocations, injuries.	M	H	H	**unacceptable**
6	Incorrect lighting at the work station.	Lack or bad lighting. Inadequate lighting fitting.	Eyesight organ diseases.	M	M	M	**acceptable**
7	Chemical factors.	Dissolvent. Dust. Glues.	Poisonings. Respiratory tract diseases. Allergy effects.	M	M	M	**acceptable**
8	Excessive physical effort.	Lifting, transfer of heavy objects.	Rupture. Spine injuries. Heart failure. Movement organ diseases.	H	H	H	**unacceptable**
9	Dustiness.	Ineffective ventilation at the work station or lack of ventilation.	Headaches, sultriness. Respiratory tract diseases and pneumoconiosis.	M	H	H	**unacceptable**
10	Drop of an element during assembly or manoeuvring.	Lack of coordination in a team work.	Injuries of limbs, trunk or head. Cut wounds.	M	M	M	**acceptable**
11	Means of underground transport.	Lack of freedom of movement. Inattention.	Serious body injuries.	H	M	H	**unacceptable**

No.	Threats	Threats source	Possible effects of a threat	Effect (E)	Probability (P)	Risk (R)	Risk acceptability
12	Impact by dropping lumps of coal and rocks, squeeze, entombment.	Geological conditions.	Serious body injuries. Death.	H	M	H	**unacceptable**
13	Communication accident.	Usage of a business car. Public communication movement.	Invalidity. Injuries. Death.	H	M	H	**unacceptable**
14	Overload of the muscular-osseous system by a forced body position.	Long-lasting work connected with a mechanical and manual working. Assembly and disassembly of devices and constructions.	Pain in the muscles. Degeneration of articulations and spine.	M	H	H	**unacceptable**
15	Natural threats in the mining industry (crumps, endogenous fire, gas explosion).	Earth movements connected with output, emission of gases from mining mine faces, abandoned workings after output.	Serious injuries, burns, death.	H	M	H	**unacceptable**

Table 6.
Card of the occupational risk assessment for the storekeeper work station after eliminating and reducing action usage

No.	Threat	Preventive means usage for risk reduction	Effect (E)	Probability (P)	Risk (R)	Risk acceptability
2	Fall at the lower level.	Use technically efficient ladders and keep safety rules during the work with them.	M	L	L	**acceptable**
3	Squeeze. Stroke. Push.	Proper marking of the cabinets. Observance of the manufacturer information about the quantity of weight. Placing of the heaviest objects on the lowest landings. Fixation of cabinets. Unloading begin from the highest surfaces. Assign the transport ways. Use the personal protection means.	M	L	L	**acceptable**
7	Overload of the muscular-osseous system.	Observance of the regulations of an individual transport. Use breaks and rotation of the workers employed for the heaviest work.	M	L	L	**acceptable**
10	Fire. Explosion.	Observance of the recommendations in the fire-fighting instructions. The accommodations should have the fire-fighting equipment.	M	L	L	**acceptable**
12	Communication accident.	Observance of the highway code. Exercise care during movement in the road traffic. Limitation of a trust for the other road users.	M	L	L	**acceptable**

Table 7.
Card of the occupational risk assessment for the hydraulics mining work station after eliminating and reducing action usage

No.	Threat	Preventive means usage for risk reduction	Effect (E)	Probability (P)	Risk (R)	Risk acceptability
2	Movement machines and devices. Chips of a stock.	Observance of the recommendations of the technical-movable documentation of the machines and devices. Use protective clothing and personal protection means. Use goggles against the chips.	H	M	M	**acceptable**
3	Noise.	Fix the machines and devices according to the technical documentation. Technically efficient machines, devices and electro tools only use. The personal protection means strictly use (hearing protectors).	M	M	M	**acceptable**
4	Electric shock.	Differential-current switches use. Their technical condition regularly control. Use efficient electro tools equipped with insulating fixtures.	M	L	L	**acceptable**
5	Objects stroke.	Technically efficient tools only use. Use protective gloves and other personal protection means. Properly equip the metal-work station. Fix the objects during a manual or mechanical treatment.	M	M	M	**acceptable**
8	Excessive physical effort.	Observance of the rules during individual transport. Make regularly a medical examinations. Usage of auxiliary means in a manuals work (e.g. hand truck). Work in a group during transport.	M	L	L	**acceptable**
9	Dustiness.	The assurance of effective ventilation. Proper organization of welding station. Usage of individual means of a respiratory tract protection.	L	M	L	**acceptable**
11	Means of underground transport.	Proper training of the workers concerning movement in the environment of underground transport. Proper arrangement of assembly place.	H	L	M	**acceptable**
12	Impact by dropping lumps of coal and rocks, squeeze, entombment.	Observance of the coal mining regulations. The workers trainings. Proper mining inspection. Use personal protection means (e.g. helmet, gloves, goggles). Avoidance of threats.	M	M	M	**acceptable**
13	Communication accident.	Observance of the highway code. Exercise care during movement in the road traffic. Limitation of a trust for the other road users.	M	L	L	**acceptable**
14	Overload of the muscular-osseous system by a forced body position.	Apply breaks in the work. Change action during the wok. Usage of knee pads if necessary.	L	L	L	**acceptable**
15	Natural threats in the mining industry (crumps, endogenous fire, gas explosion).	Continuous monitoring of threatened areas. The assurance of effective ventilation. Effective seismography. Proper isolation of threatened areas. Proper protection of the work stations, personal protection means. Trainings of the personnel.	M	L	L	**acceptable**

4.3. Actions eliminating or reducing the occupational risk

Implementation of eliminating or reducing risk actions one should begin from the threats for which the risk is unacceptable.

In case of unacceptable risk the eliminating actions should have the immediate character. The medium risk is acceptable, but it requires the workings in the aim of its reduction continuation. The risk defined as a low requires workings assuring that it will stay at the same level [1, 11].

For every estimated work station and identified threats on it correcting actions and eliminating (reducing) risk means were proposed (Tables 6 and 7). Next repeated occupational risk assessment was carried out. It will be done in order to verification of using of eliminating actions.

5. Conclusions

The analysis of the work stations in the enterprise disclosed many threats occurring during personnel work.

Preparation and usage of the cards of threats identification made possible the unequivocal qualification where and in what situations of the everyday work these threats occur and what is their cause. Next, the occupational risk assessment for two chosen work stations was carried out.

On the basis of results of the analysis correcting actions proposed. Next, the occupational risk assessment after consideration of these actions carried out.

The results confirmed efficiency and relevance of the proposed measures. The risk in all cases was minimized from unacceptable to acceptable level.

References

[1] A. Kania, M. Spilka, R. Nowosielski, Analysis of industrial threats on the chosen example, Archives of Materials Science and Engineering 47/2 (2011) 117-124.

[2] T. Karkoszka, Improvement of the chosen process based on the occupational health and safety criterion, Journal of Achievements in Materials and Manufacturing Engineering 37/2 (2009) 735-742.

[3] T. Karkoszka, D. Szewieczek, Occupational risk assessment in the process of continuous steel casting, Journal of Achievements in Materials and Manufacturing Engineering 24/2 (2007) 207-210.

[4] T. Lis, K. Nowacki, Occupational health and safety management in an industrial plant, Silesian University of Technology Publishers, Gliwice, 2005 (in Polish).

[5] R. Studenski, Arrangement of the safety work in enterprise, Silesian University of Technology Publishers, Gliwice, 1996 (in Polish).

[6] Act of 26 June 1974 – the Labour Code (Journal of Laws of 1998, No. 21, it. 94, as amended).

[7] Council Directive of 12 June 1989 on the introduction of measures to encourage improvements in the safety and health of workers at work (89/391/EEC).

[8] M. Spilka, A. Kania, Influence of management system on the safety level in chosen enterprise, Journal of Achievements in Materials and Manufacturing Engineering 39/1 (2010) 95-102.

[9] M. Spilka, A. Kania, R. Nowosielski, Integration of management systems on the chosen example, Journal of Achievements in Materials and Manufacturing Engineering 35/2 (2009) 204-210.

[10] J. Lewandowski, Occupational safety management in the enterprise, Lodz University of Technology Publishers, Łódź, 2000 (in Polish).

[11] PN-N-18002. Occupational health and safety management systems. General guidelines for occupational risk assessment, PKN, Warsaw, 2000 (in Polish).

[12] T. Karkoszka, M. Andraczke, Improvement of safety by analysis of costs and benefits of the system, Journal of Achievements in Materials and Manufacturing Engineering 49/1 (2011) 95-102.

[13] C. Qing-gui, L. Kai, L. Ye-jiao, S. Qi-hua, Z. Jian, Risk management and workers' safety behavior control in coal mine, Safety Science 50 (2012) 909-913.

[14] A. Badri, A. Gbodossou, S. Nadeau, Occupational health and safety risks: Towards the integration into project management, Safety Science 50 (2012) 190-198.

[15] R.B. Ward, The management of accidents, Journal of Achievements in Materials and Manufacturing Engineering 32/1 (2009) 75-80.