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From Editor's desk

The human mind is like a parachute - it functions better when it is open.

Albert Einstain

The positive response of the scientific and professional audience in the field of environmental safety, occupational safety and fire protection strengthened our determination to continue publishing the journal of this kind..

In order to make the ideas and brand new information from the journal scientific areas available to the wider scientific community, in addition to the hard copy, we created an electronic version of this journal which can be found on www.safety.ni.ac.rs.

In accordance with the adopted concept of OPEN ACCESS journals, the journal will be indexed in DOAJ - Directory of Open Access Journals. Each article will be assigned a unique DOI number (Digital Object Identifier).

The Editorial Board of the Journal follows the science news and the latest scientific achievements within the journal's field, with the aim to offer selected and quality information to the readers. This primarily refers to the information from international conferences in our region. A very important conference "The first international conference on radiation dosimetry and in various fields of research - RAD 2012" was held in Niš in April 2012. The Conference report can be read in this issue of the journal, while the most significant contributions – according to the editors' and reviewers' opinions – will be presented in the next issue

This issue provides an overview of the book Safety Sistem Fundamentals by Prof. Dr. Branislav Anđelković and the book entitled Alarm Systems by Prof. Dr. Milan Blagojevic.

Um je poput padobrana - funcioniše samo kad je otvoren.

Albert Ajnštajn

Pozitivni odziv naučne i stručne javnosti iz oblasti zaštite životne sredine, zaštite na radu i zaštite od požara učvrstio nas je u odluci da je potrebno nastaviti sa izdavanjem ovakvog časopisa.

U želji da ideje i nove informacije iz naučnih oblasti kojima se časopis bavi učinimo dostupnim široj naučnoj javnosti, pored papirne verzije, napravili smo i elektronsku verziju ovog časopisa koju možete naći na web adresi *www.safety.ni.ac.rs*.

U skladu sa usvojenom koncepcijom OPEN ACCESS časopisa, Safety Engineering će od ovog broja biti indeksiran u DOAJ (*Directory of Open Access Journal*), a svaki rad imaće jedinstveni DOI broj (*Digital Object Identifier*).

Uređivački odbor časopisa prati naučne novosti i dostignuća iz oblasti interesovanja časopisa, sa ciljem da čitaocima pruži odabrane i kvalitetne informacije. Ovo se prvenstveno odnosi na informacije sa međunarodnih konferencija u našem okruženju. U aprilu 2012 je održana izuzetno značajna konferencija "The first international conference on radiation and dosimetry in various fields of research - RAD 2012" u Nišu. Izveštaj sa ove konferencije možete naći u ovom broju časopisa, dok će u narednom broju biti predstavljeni najznačajniji radovi po oceni urednika i recenzenata časopisa.

U ovom broju časopisa dat je prikaz knjiga prof. dr Branislava Anđelkovića „Osnovi sistema zaštite" i prof. dr Milana Blagojevića "Alarmni sistemi".

On behalf of the editors

Doc. Dejan Krstić, PhD

Contents

Original Scientific Articles

Tatjana Golubović, Bojka Blagojević
Transfer and bioaccumulation of heavy metal ions from soil into plants 1

Eva Mračková
Fire safety – determination the lower explosion limit in explosion chamber for selected flammable liquids 5

Živković Snežana, Todorović Miliša, Markič Mirko
Comparative analysis of the effects of organizational culture on occupational safety and health at work system in business organizations in Slovenia and companies in Serbia 11

Josip Taradi, Zdravko Krakar, Vesna Nikolić
Model Of Occupational Injury Information System And Knowledge Management 19

Maja Meško, Jera Zajec, Zlatka Meško Štok, Mirko Markič
Experiencing stress and stress symptoms among slovene managers 27

Arjan Shumeli, Albert Kopali, Etleva Jojiç
Hazards related to collection, transportation and disposal of urban waste in Tirana municipality 33

Scientific Articles - Review Articles

Blagoja Markovski, Leonid Grčev, Marija Kacarska
Overview on the reference levels for low frequency electric and magnetic fields in the legislation of Southeast European Countries 37

Jovica Jovanović, Nataša Djindjić, Boris Djindjić
Occupational diseases induced by vibrations 41

Branislav Anđelković
Occupational safety in the context of modern technological changes 47

Book Reviews

Branislav Anđelković
Safety System Fundamentals 54

Milan Blagojević
Alarm Systems 55

Conference Report
First International Conference on Radiation and Dosimetry in Various Fields of Research (RAD 2012) 56

Conference announcement
Call for papers for 23rd National & 4th International Conference NOISE AND VIBRATION 57

Propagation Corner

ALEKSANDAR INŽENJERING D.O.O. Novi Sad, Srbija
Measuring instruments 58

SEIBL – TRADE doo, Beograd
Occupational safety equipment 59

Sadržaj

Originalni naučni radovi

Tatjana Golubović, Bojka Blagojević
Transfer i bioakumulacija jona teških metala iz zemljišta u biljke 1

Eva Mračková
Određivanje donje granice eksplozivnosti u komori za sagorevanje za pojedine zapaljive tečnosti sa aspekta zaštite od požara 5

Živković Snežana, Todorović Miliša, Markič Mirko
Komparativna analiza uticaja organizacione kulture na sistem bezbednosti i zdravlja na radu u poslovnim organizacijama u Sloveniji i privrednim društvima u Srbiji 11

Josip Taradi, Zdravko Krakar, Vesna Nikolić
Model upravljanja informacionim sistemom i znanjem o povredama na radu 19

Maja Meško, Jera Zajec, Zlatka Meško Štok, Mirko Markič
Stres i simptomi stresa kod menadžera u Sloveniji 27

Arjan Shumeli, Albert Kopali, Etleva Jojiç
Opasnosti vezane za prikupljanje, prevoz i odlaganje urbanog otpada u opštini Tirana 33

Pregledni radovi

Blagoja Markovski, Leonid Grčev, Marija Kacarska
Pregled referentnih nivoa za niskofrekventna električna i magnetna polja u državama jugoistočne Evrope 37

Jovica Jovanović, Nataša Djindjić, Boris Djindjić
Profesionalne bolesti izazvane vibracijama 41

Branislav Anđelković
Zaštita na radu u kontekstu savremenih tehnoloških promena 47

Prikazi publikacija

Branislav Anđelković
Osnovi sistema zaštite 54

Milan Blagojević
Alarmni sistemi 55

Izveštaj sa konferencije
Prva međunarodna konferencija o zračenju i dozimetriji u različitim oblastima istraživanja (RAD 2012) 56

Conference announcement
Prvi poziv za 23. nacionalnu i 4. međunarodu konferenciju „Buka i Vibracije“ 57

Oglašavanje

ALEKSANDAR INŽENJERING D.O.O. Novi Sad, Srbija
Prodaja i servis mernih instrumenata 58

SEIBL – TRADE doo, Beograd
Sredstva i oprema za zaštitu na radu 59

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TRANSFER AND BIOACCUMULATION OF HEAVY METAL IONS FROM SOIL INTO PLANTS

Abstract: *The soil is a thin surface layer of the Earth's crust formed in long-term, mutual interactions between rocks, climate and living beings. It is, conditionally, one of the renewable resources due to the long process of formation and development. The widespread contamination of soils, particularly with heavy metals, is currently one of the most serious environmental concerns. Although a small portion of heavy metals in soil is derived from natural processes, a much higher amount originates from anthropogenic sources such as industry (mining and smelting), agriculture (use of mineral fertilizers and pesticides) and transportation (automobiles and aircraft). The aim of this paper is to show the relation between the heavy metal ions content in soil and their bioaccumulation in plants. The accumulation of heavy metal ions depends on various biotic (plant species, genotype, developments stage, etc.) and abiotic factors (qualitative and quantitative characteristics of heavy metals, temperature, pH value, ion interactions, etc.). One of the abiotic factors which has recently been in focus of the research, and which is important for uptake and physiological effects of pollutants, is the interaction of ions which relate to antagonism and synergism.*

Key words: heavy metals, bioaccumulation, plants, antagonism, synergism.

INTRODUCTION

The soil is a basic natural resource which quality presents the basis of sustainable development of agriculture and forestry. Some pollutants, including heavy metals, from anthropogenic sources occur in the environment, subside in soil and have influnce on pedogenetic processes. Today, soil contamination with heavy metals is an environmental problem on a global scale, and it is becoming increasingly important as industrialization, urbanization, development of agriculture and transportation increase [1]. Heavy metals are long-term contaminants with the ability to accumulate in soil and plants [2]. All plants show a certain reaction in terms of increasing of toxic elements concentration in soil, depending upon the sensitivity of plants exposure intensity and chemical species. Some species of plants disappear from such lands, while others, on the contrary, are stimulated by these elements. In case of land which contain metals, some plant species (metalophytes) have developed tolerance towards metals ions, while others (hyperaccumulators) are characterized by the capacity to accumulate high concentration of metal ions in their tissues. The accumulation of heavy metal ions depends on various biotic and abiotic factors. One of the abiotic factors which has recently been in focus of the research, and which is important for the uptake and physiological effects of heavy metals ions, is their interaction which relate to antagonism and synergism [3,4]. The properties of plants to accumulate heavy metals were used for purification of the contaminated soil. This technology – phytoremediation - can be defined as the efficient use of plants to remove, detoxify or immobilize environmental contaminants in a growth matrix (soil, water or sediments) through the natural, biological, chemical or physical activities and processes of the plants [5,6].

HEAVY METALS

The term heavy metals applies to the group of metals and metalloids with atomic density greater than 5 g/cm^3 and atomic number greater than 20 [7,8,9]. Also, they are known as "toxic metals" [9]. Heavy metals can be divided into two groups: essential heavy metals and toxic metals. Certain heavy metals (Fe, Cu and Zn) are essential for plants and animals [10]. The availability of heavy metals in medium varies, and metals such as Cu, Zn, Fe, Mn, Mo, Ni and Co are essential micronutrients [11], whose uptake in excess to the plant requirements result in toxic effects [12,13]. They are also called "trace elements" due to their presence in trace (10 mg kg^{-1}) or in ultra trace (1 μg kg^{-1}) quantities in the environmental matrices. The essential heavy metals (Cu, Zn, Fe, Mn and Mo) play biochemical and physiological functions in plants and animals. Two major functions of essential heavy metals are: (a) Participation in redox reaction, and (b) Direct participation, being an integral part of several enzymes. On the other hand, toxic metals (Pb, Cd, Hg and As) have no physiological function.

Source of heavy metals contamination

The sources of heavy metals can be both natural and anthropogenic (agricultural, industrial, domestic effluent and other). The most important natural source of heavy metals is geologic parent material. Furthermore, important natural sources are volcanoes, wind dust, marine aerosols and forest fires [14]. Agriculture is one of the anthropogenic sources of contamination. Namely, inorganic and organic fertilizers are the most important sources of heavy metals in agricultural soil, since they include pesticides, irrigation waters and sewage sludge [15]. Regarding the industrial sources of heavy metals, they include mining, processing of plastics, textiles, microelectronics, wood preservation, paper processing, etc. With regard to pollution from urbanized areas, there is an increasing awareness that urban runoff presents a serious problem of heavy metal contamination [16]. Significant sources of heavy metals include refuse incineration, landfills and transportation (automobiles, aircraft etc.).

Factors influencing the uptake and transfer of heavy metals ions

The uptake of heavy metal ions depends on various biotic (plant species, genotype, developments stage, etc.) and abiotic factors (qualitative and quantitative characteristics of heavy metals, temperature, soil pH, ion interactions, soil aeration, Eh condition, etc.) [17]. Plants take heavy metals from soils through different reactions such as: absorption, redox reactions, ionic exchange, etc. The solubility of metals depends on minerals in soil (carbonates, oxide, hydroxide etc.), soil organic matter (humic acids, fulvic acids, polysaccharides and organic acids), as well as soil pH, redox potential and soil temperature [18]. For example, soil acidity has a major impact on ion mobility and their uptake by the plant (Figure 1).

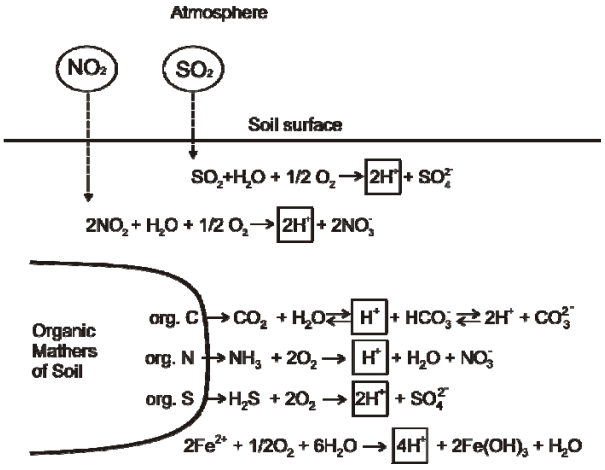

Figure 1. *Reactions that can cause the increase of soil acidity*

These facts indicate that only available ions are transferred in plants. The concentration of heavy metal ions in the environment is one of the most important factors for their uptake. Increasing ion concentration in the environment cause the increase of their content in plants; however, the increase is not linear but asymptotic. One of the abiotic factors which is important for uptake and physiological effects of heavy metals ions, as well as their concentration in environment, is a mutual interaction among various ions which relate to antagonism and synergism. Antagonism of ions is caused by the difference in their diameters, valences and electrical conductivity [19]. Antagonism of calcium and lead (Ca and Pb) is very important. If two heavy metals are found together on a nutritious medium, and if the contents of one of them exceeded the threshold of toxicity, that leads to their synergistic effects (heavy metals such as Cd and Zn).

Distribution of metals in plant

Metals distribution in plants is quite heterogenous and caused by the genetic factors, environment and toxic factors. The metals distribution in plant seems to be controlled by some mechanism and this suggests the existence of some boundaries and/or change in the metal chemical state [18]. Different plant parts contain different quantities of heavy metals, the highest ones being contained in roots and leaves, and the smallest in flower buds and fruit. The content of heavy metals of the roots may indicate the degree of these pollutants accumulation in the polluted soil, whereas the content of heavy metals on leaves may even suggest the atmosphere pollution degree.

Bioaccumulation of heavy metals in plant

The ability of the accumulation of pollutants in plants is often defined by the coefficient of bioaccumulation (ratio of concentrations of pollutants in the plant and the initial concentration in the medium). Usually, one plant species has a higher affinity to only one substance.

Our previous research of heavy metals in medicinal plants and soil, have shown that some plants such as *Sambucus nigra* L. contain higher content of cadmium in the flower, in relation to its content in the soil [20]. This has led us to determine the coefficient of bioaccumulation as an indicator of heavy metal phytoextraction (Table 1).

Table 1. *The content of heavy metals in plant species Sambucus nigra L. and soil; Coefficient of bioacumulation of heavy metals in plant species Sabucus nigra L.*

	the content of cadmium (mg/kg)	coefficient of bioaccumulation	the content of lead (mg/kg)	coefficient of bioaccumulation	the content of nickel (mg/kg)	coefficient of bioaccumulation
Locality Miljkovac	0.58	3	29.27	<1	52.69	<1
Flower *Sambucus nigra* L.	1.74		1.83		3.16	

Also, the coefficient of bioaccumulation was determined for selenium in some medicinal plants [21]. The content of selenium in soil has be presented in Table 2, while the content of selenium in plant species of the genus *Astragalus* L. and *Silene* L. and coefficient of bioaccumulation has be shown in Table 3.

Table 2. *The content of selenium in soil*

Substrate	Locality	The content of selenium (μg/kg)
Soil	Bregovi (Rudina mountain)	230
The parent substrate	Bregovi (Rudina mountain)	220
Soil	Ploče (Rudina mountain)	236

Table 3. *The content and coefficient of bioaccumulation of selenium in genus Astragalus L. and Silene L.*

Plant speces	Locality	The content of selenium (μg/kg)	Coefficient of bioaccumulation
Astragalus onobrichys L.	Ploče (Rudina mountain)	236	1
Astragalus angustifolius L.	Bregovi (Rudina mountain)	270	1.1
Astragalus vesicarius L.	Ploče (Rudina mountain)	290	1.3
Silene supina L.	Bregovi (Rudina mountain)	255	1.1

Phytoremediation

Phytoremediation is a new, inexpensive and environmentally friendly technology that is based on the use of green plants to remove pollutants from the environment. The ability of plants to accumulate metals has evolved during the long evolution of growth on soils rich in metals. Today, these plants are commonly used to remove heavy metals from soil and transform them into harmless forms. Most commonly used methods for removing heavy metals are phytoextraction, phytostabilisation, etc. The choice of method depends on: the characteristics of soil and heavy metals with the necessary knowledge of soil texture, mechanical and chemical composition, the amount of organic matter, soil pH, characteristic of heavy metals, their interactions with other elements in the soil, etc.

CONCLUSION

Heavy metal toxicity and the danger of their bioaccumulation in the food chain represent one of the major environmental and health problems of the contemporary society. In recent years, scientists have started to generate cost effective technologies which include the use of plants for cleaning polluted areas. Phytoremediation is an emerging technology, which should be considered for remediation of contaminated sites because of its cost effectiveness, aesthetic advantages and long term applicability. This technology can be defined as the efficient use of plants to remove, detoxify or immobilize environmental contaminants in a growth, through the natural, biological, chemical or physical activities and processes of the plants Also, phytoextraction is the use of live green plants in order to remove inorganic contaminants, primarily metals, from polluted soils and concentrate them into roots and easily harvestable shoots. Knowledge of the interaction of heavy metals is very important especially when soil was polluted with high concentration of heavy metals. Starting from the fact that the nickel from the soil stimulates the translocation of cadmium in the shoot, we performed phytoremediation of contaminated soil, which has been one of the issues investigated in our research.

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BIOGRAPHY

Tatjana Golubović was born in Niš, Serbia, in 1969. She received the diploma in Chemistry, and the Ph.D. degree in Chemistry from Department of Chemistry, Faculty of Science and Mathematics, University of Niš.

Her main areas of research include chemistry, environmental chemistry, soil protection and eco-toxicology. She is currently working as an associate professor at the Faculty of Occupational Safety in Niš, University of Niš.

TRANSFER I BIOAKUMULACIJA JONA TEŠKIH METALA IZ ZEMLJIŠTA U BILJKE

Tatjana Golubović, Bojka Blagojević

Rezime: *Zemljište je tanak površinski sloj Zemljine kore nastao dugotrajnim i uzajamnim delovanjem matične stene, klime i živih bića. Ubraja se u uslovno obnovljive resurse s obzirom na dugotrajne procese nastanka i razvoja. Sve rasprostranjenija kontaminacija zemljišta, posebno teškim metalima, trenutno je jedan od najozbiljnijih problema životne sredine. Manji deo teških metala u zemljištu potiče od prirodnih procesa, dok mnogo veći deo potiče iz antropogenih izvora poput industrije (rudnici i topionice), poljoprivrede (upotreba mineralnih đubriva i pesticida) i saobraćaja (automobilski i avionski). Cilj ovog rada je da ukaže na odnos između koncentracije jona teških metala u zemljištu i njihove bioakumulacije u biljkama. Akumulacija jona teških metala zavisi od mnogobrojnih biotičkih (biljna vrsta, genotip, faza razvoja itd.) i abiotičkih faktora (kvalitativne i kvantitativne karakteristike teških metala, temperature, pH zemljišnog rastvora, interakcije jona, itd.). Jedan od abiotičkih faktora koji je u poslednje vreme u fokusu istraživanja i koji je značajan zbog usvajanja i fiziološkog dejstva zagađujućih supstanci, je interakcija jona koja se ogleda u njihovom međusobnom antagonizmu i sinergizmu.*

Ključne reči: teški metali, bioakumulacija, biljke, antagonizam, sinergizam.

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FIRE SAFETY – DETERMINATION THE LOWER EXPLOSION LIMIT IN EXPLOSION CHAMBER FOR SELECTED FLAMMABLE LIQUIDS

Abstract: *This article describes the experiments in explosion chamber VK 100. The chamber is used to determine the lower explosive limit (LEL) of selected aliphatic alcohols (methanol, ethanol) as flammable liquids. First, the calculations of the volume of flammable liquid necessary for setting LEL were carried out. Secondly, the lower explosive limit of methanol and ethanol was determined experimentally. We compared them with the technical characteristics of fire safety data sheets. All two aliphatic alcohols (methanol, ethanol) are considered as fuels.*

Key words: flammable liquids vapours, lower explosive limit, methanol, ethanol, alcohol fuels, explosive chamber.

INTRODUCTION

Although fossil fuels have become the dominant energy resource in the modern world, alcohol has been used as a fuel throughout the history. The aliphatic alcohols - methanol and ethanol - are of interest as fuels because they can be synthesized chemically or biologically, and they have characteristics which allow them to be used in current engines. Mutual characteristics for all four alcohols is their high octane rating.
Determination of the lower explosivene limit (LEL) has an extraordinary importance for the assessment of explosion danger inside technological systems with explosive atmosphere which is formed by flammable liquid vapours, such as methanol, ethanol and air oxygen. Knowledge of the LEL value is directly used to determine the atmosphere, with respect to fire danger or flammable liquid vapours explosion, according to technical standard STN EN 1127-1 Explosive atmospheres.

EXPLOSION

An explosion can occur in a closed area if a finely dispersed flammable material in sufficient concentration is blended with an oxidizing agent. In addition, a sufficiently strong source of initiation must be present. Flammable material may be flammable gas, flammable liquid vapour or mist, stirred flammable dust or a combination of these materials called hybrid blend [1].

The measurement method for determining the lower explosivene limit is based on the ability of flammable liquid vapours to burn explosively with oxygen after they have been ignited by a source of ignition. The lower explosiveness limit is the minimum concentration of the flammable liquid vapours with an oxidizer, which enables the spread of the explosive burning. It forms the boundary between an explosive and non explosive mixture. It is a number determining the minimum amount of homogeneously dispersed combustible matter in an oxidizing atmosphere (air) that, after being initiated by a sufficiently powerful initiation, is able to develop a temperature high enough to ignite next, not yet reacting layers of the mix [1].

THE AMOUNT OF THE EXPLOSIVE MIXTURE

The density of flammable liquid vapours with air is given by the pressure of liquid vapours, which depend on the temperature. Vapours of a liquid methanol and ethanol, with lower density than of the air, rise faster since their density is lower. During this process, they gradually mix with air. The coefficient of diffusion determines the amount of an explosive mixture in a closed space, only if there is no air flow. In case of the air flow, this amount is influenced especially by convection.

The formation of an explosive atmosphere is influenced by operating conditions - if the material is in closed space, if there is an outflow possibility, aerating or the spatial distribution. For example, we must take into account the presence of flammable materials and mixtures in spaces which are not ventilated enough, such as holes, sewers and shafts. In case of gases and vapours, even small air ventilation (a natural draught, movement of a person) can cause air to mix with combustible substances [2].

In case of liquids such as methanol and ethanol, the surface area of vaporization and the working temperature have influence on the formation of an explosive atmosphere.

LIQUID VAPOURIZATION IN A STAGNANT ENVIRONMENT

Vaporization of flammable liquids, such as methanol and ethanol, into a stagnant environment is called molecular diffusion. It is a relatively slow process, which does not enable the liquid vapours to spread to large distances. On the contrary, it enables the vapour to concentrate at its source, and hence creating local explosive concentrations.

The concentration change above the surface can be described by the formula as in Eqn. (1),

$$c = a \,.\, y^n + b \qquad (1)$$

Where:

c - vapour concentration at the considered point over the flammable liquid surface [volume %]

y - distance of the considered point from the origin of the coordinate system [m]

a, b - constants, which can be defined from the boundary conditions [-]

LABORATORY PART

Experimental equipment VK 100

Explosive Chamber VK 100 is a cubic. Its length l is less or equal to two diameters d : $l \leq 2.d$. With the increasing capacity of the vessel decreases the rapidity of explosive pressure growing. In case of cubic vessels, this characteristic is described by the so-called Cubic relation as in Eqn. (2),

$$\left(\frac{dp}{dt}\right)_{\max} .V^{1/3} = konst. = K_G, resp.K_{St} \qquad (2)$$

where:

(dp/dt)max - the maximum speed of the explosive pressure growth [MPa.s^{-1}] or [bar.s^{-1}]

V - capacity of the vessel [m^3]

K(G), K(St) - cubic constant for gases or dusts [MPa.m.s^{-1}] or [bar.s^{-1}]

This cubic constant can be a technically safety parameter if the following conditions are satisfied – the optimal concentration of explosive mixture, the same shape of the vessel, the same rate of mixture turbulence and the same kind and energy of the initiating source - as it is the case with VK 100. Validity of the cubic relation according to [3] in case of flammable liquids vapour mixtures begins from a vessel capacity 5 l and in the case of dust-air mixtures from a capacity 40 l.

Description of the technical apparatus for measuring the lower explosive limit and the explosiveness volume- area

The technical apparatus for the lower explosive limit measuring - explosion chamber VK 100 - is laboratory equipment for the determination of explosiveness limits of flammable liquid vapours. The equipment has a frame construction, the chamber itself is on the upper part of the frame; on the bottom part, there are the pneumatic valves, the stirring equipment, the explosion source, the fire extinguishing equipment and the additional electronics.

Inside the chamber, there is a heating plate which can be taken out and which serves the evaporation of the tested liquid. This plate is powered by 24 VAC, the temperature is scanned by a thermocouple and regulated by a HT60B regulator (Figure 1, 2).

Two high voltage electrode leads aimed at initiation are inserted into the chamber inner space. The chamber has further a gas input, an electro valve for flammable liquid gases stirring, an electro valve for chamber cleaning and an electro valve of the fire extinguishing equipment. Inside the chamber, an intensive streaming can be carried out by the use of a blender with variable rotation speed. The device control is provided by an external desk, where the operating elements are placed in vertical plane. Their functions are mutually locked-out in the particular modes. This allows a safe operation and forecloses an accidental hanging.

Figure 1. *Operator control unit VK 100*

Figure 2. *Inner space of VK 100*

EXPERIMENTAL SUBSTANCE - METHANOL AND ETHANOL - FLAMMABLE LIQUIDS BELONGING TO ALCOHOL GROUP

Methanol is mainly produced from natural gas, although it can be produced from biomass using very similar chemical processes. Ethanol is commonly produced from biological material though fermentation processes. When obtained from biological materials and/or biological processes, they are known as bioalcohols (e.g. bioethanol). There is no chemical difference between biologically produced and chemically produced alcohols [4].

Methanol and ethanol can be both derived from fossil fuels, biomass, or perhaps most basically, from carbon dioxide and water. Ethanol has most commonly been produced through fermentation of sugars, while methanol has most commonly been produced from synthesis gas, but there are more modern ways to obtain these fuels. Methanol is the simple molecule, whereas ethanol can be made from methanol and produced industrially from nearly any biomass, including animal waste, or from carbon dioxide and water or steam by first converting the biomass into synthesis gas in a gasifier. It can also be produced in a laboratory using electrolysis or enzymes [4].

For industrial use, ethanol is produced by a reaction of ethylene with sulphuric acid, by catalytic hydratation of ethylene and by synthesis from fossil materials or gas. The so-called ethanol fermentation and the following distillation of ethanol is another method. Ethanol is the basic component of alcoholic drinks. Also, it is used as solvent (medicines, cosmetics, cleaning and disinfecting agents, etc.) and as a base material for further processing (acetaldehyde, butadiene, diethyl ether, ethylene, vinegar, etc.) [4].

Table 1. *Basic characteristics of methanol [5]*

molecular formula	CH_3OH	structural formula	H_3C-OH
CAS number	67-56-1	molecular weight	30,04 $g \cdot mol^{-1}$
melting temperature	- 97°C	boiling temperature	64,7°C
density at 20°C	791,8 $kg \cdot m^{-3}$	vaporization heat	1098,94 $kJ \cdot kg^{-1}$
heat of formation	- 239,2 $kJ \cdot mol^{-1}$	combustion heat	22,68 $MJ \cdot kg^{-1}$
LEL	6,0 volum %	UEL	36,5 volume%
flash temperature	12°C	self-ignition temperature	464°C

Table 2. *Basic characteristics of ethanol [5]*

molecular formula	C_2H_5OH	structural formula	CH_3-CH_2-OH
CAS number	64-17-5	molecular weight	46,07 $g \cdot mol^{-1}$
melting temperature	-114,15°C	boiling temperature	78,39°C
density at 20 °C	789,42 $kg \cdot m^{-3}$	vaporization heat	836,99 $kJ \cdot kg^{-1}$
heat of formation	- 277,6 $kJ \cdot mol^{-1}$	combustion heat	29,67 $MJ \cdot kg^{-1}$
LEL	3,5 volume %	UEL	15 volume%
flash temperature	13°C	self-ignition temperature	363°C

Formula of 1 mol fuel complete combustion is as in Eqn. (3),

$$C_2H_5OH+3O_2+11{,}28N_2 \xrightarrow{-1366{,}83\ kJ} 2CO_2+3H_2O+11{,}28N_2 \quad (3)$$

Aerosols of liquids and mists create drops with a size less than 1 mm. Practically, there are often aerosols and mist drops with proportions of 0,001 mm and 0,1 mm. In case of gases and superheated vapours of flammable liquids in mixtures with air, oxygen, chlorine and other oxidizing agents, an explosion hazard threatens if:

Safety factors are usually considered as in Eqn. (4),

$$k_{B1} \cdot LEL < c_{SKUT} < k_{B2} \cdot UEL \quad (4)$$

$k_{B1} = 0{,}5$,
$k_{B2} = 1{,}04$ till 1,1 for low UEL rate
$k_{B2} = 1{,}32$ till 2,52 for high UEL
rate (e.g. H_2, C_2H_2, CH_3OH.)

METHODS OF RESULTS ASSESMENT

Calculation method for the assessment of volume concentration for Methanol and Ethanol

The mode of evaluation is based on physical, chemical and dynamic principles of a liquid behaviour. Vapour concentration above the liquid surface is directly proportional to the saturated vapours pressure, as in Eqn. (5),

$$c_{SKUT} = \frac{p_n}{p_o} \cdot 100\% \quad (5)$$

Where:
c_{skut} - vapour concentration [volume %]
p_n - liquid saturated vapours pressure [Pa]
p_0 - pressure of the surrounding [Pa]

The molar volume V_t at the temperature t_{PRAC} is used for calculation as in Eqn. (6),

$$V_t = V_o \cdot \frac{T_{PRAC}}{T_o} \frac{p_o}{p_{PRAC}} \quad (6)$$

Where:
V_o = 22,4135 $m^3 \cdot kmol^{-1}$ (at T_0 and p_0)
p_o = 1,01325·10^5 Pa
$T_{PRAC} = t_{PRAC}$ + 273,15 K
T_o = 273,15 K
t_{PRAC} - working temperature [°C]
p_{PRAC} - working pressure [Pa]

The calculation of the gas capacity results from the state equation of a perfect gas which has the form Eqn. (7),

$$p \cdot V = n \cdot R \cdot T \quad (7)$$

whereas for the amount of substance n stands as in Eqn. (8),

$$n = \frac{m}{M} \quad (8)$$

Because the liquid weight is a non-measurable quantity, it is necessary to express it via capacity and via density, using the formula as in Eqn. (9),

$$m_{kvap} = V_{kvap} \cdot \rho \quad (9)$$

Through the combination of formulas (11) and (12), we get the final form of the formula for liquid volume calculation as in Eqn. (10),

$$V_{kvap} = \frac{V_{plyn} \cdot M \cdot p}{\rho \cdot R \cdot T} \quad (10)$$

Where:
n - amount of substance [mol]
m - mass of the gas [g]
M - gram molecule of the gas [g·mol^{-1}]
R - universal gas constant [8,314 Pa·m^3·K^{-1}·mol^{-1}]
T - gas temperature [K]
ρ - liquid density [kg.m^{-3}]
p - gas pressure [Pa]
V - gas volume at the given pressure and temperature [V]

The introduced mathematical procedure was used for the theoretic calculation of flammable liquids vapours concentration [6].

RESULTS AND DISCUSSION

Calculation Results of the needed volume V_{kvap} of the flammable liquid methanol for its LEL assessment are presented. The presented calculation is realised under the given conditions (Table 1.):
M = 30,04 g·mol^{-1}
ρ = 791,8 kg·m^{-3}
T = 20°C
$V_{\text{výbuchového priestoru}}$ = 100 l (volume of the outburst space)
On the basis of calculations, we get the results listed in Table 3.

Table 3. *Needed amount V_{kvap} for assessment of methanol LEL*

Measuring number	V_{kvap} [ml]	vapour capacity in the VK [m^3]	liquid mass [g]	LEL [volume %]
1.	8,83	0,0056	6,994	5,6
2.	8,99	0,0057	7,119	5,7
3.	9,15	0,0058	7,243	5,8
4.	9,31	0,0059	7,368	5,9
5.	9,46	0,0060	7,493	6,0

Table 4. *Experimental assessment of low explosiveness limit*

Measuring number	Flammable liquid ethanol amount [ml]	LEL [volume %]	Test results P- positive N- negative				
			Number of the experiment				
			1.	2.	3.	4.	5.
1.	8,83	5,6	P	P	P	P	P
2.	8,99	5,7	P	P	P	P	P
3.	9,15	5,8	P	P	P	P	P
4.	9,31	5,9	P	N	P	P	N
5.	9,46	6,0	N	P	P	P	P

On the basis of the experiments, the low explosiveness limit (LEL) for methanol was confirmed as 6,0 % volume. It corresponds to the literature by Wiley, VCH [5], stated in Table 1.
Calculation Results of the needed volume V_{kvap} of the flammable liquid ethanol for its LEL assessment are presented. The presented calculation is realised under the given conditions (Table 2.):
M = 46,07 g·mol^{-1}
ρ = 789,42 kg·m^{-3}
T = 20°C
$V_{\text{výbuchového priestoru}}$ = 100 l (volume of the outburst space)

On the basis of calculations, we get the results listed in Table 5.

Table 5. *Needed amount V_{kvap} for assessment of ethanol LEL*

Measuring number	V_{kvap} [ml]	Vapour capacity in the VK [m^3]	Liquid mass [g]	LEL [volume %]
1.	8,98	0,0037	7,087	3,7
2.	8,73	0,0036	6,895	3,6
3.	8,49	0,0035	6,704	3,5
4.	8,25	0,0034	6,512	3,4
5.	8,01	0,0033	6,320	3,3

Table 6. *Experimental assessment of low explosiveness limit*

Measuring number	Flammable liquid ethanol amount [ml]	LEL [volum %]	Test results P- positive N- negative				
			Number of the experiment				
			1.	2.	3.	4.	5.
1.	8,98	3,7	P	P	P	P	P
2.	8,73	3,6	P	P	P	P	P
3.	8,49	3,5	P	N	N	P	N
4.	8,25	3,4	N	N	P	N	N
5.	8,01	3,3	N	N	N	N	N

On the basis of the experiments, the low explosiveness limit (LEL) for ethanol was confirmed as 3,5 % volume It corresponds with the literature Wiley, VCH [5] stated in Table 2.

CONCLUSION

The measurement principle was used to create flammable liquid vapours with air oxygen and to produce an explosive system initiated by an energy source - starter. The purpose of the measuring was to find the minimum of a flammable liquid vapour or mist concentration in air, whereas an explosion spread occurs in the mixture at the given initiatory energy. Experiments were carried out by atmospheric pressure and the VK 100 chamber structural temperature. The results serve as the basis for technical protection systems in fire safety.

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Eva Mračková was born in Zvolen, Slovak Republic.
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ODREĐIVANJE DONJE GRANICE EKSPLOZIVNOSTI U KOMORI ZA SAGOREVANJE ZA POJEDINE ZAPALJIVE TEČNOSTI SA ASPEKTA ZAŠTITE OD POŽARA

Eva Mračkova

Apstrakt: *U radu je dat opis eksperimenata u komori za sagorevanje (eksplozivnoj komori) VK 100. Komora se koristi za određivanje donje granice eksplozivnosti (DGE) određenih alifatičkih alkohola (metanol, etanol) kao zapaljivih tečnosti. Najpre je izvršena kalkulacija količine zapaljivih tečnosti neophodnih za određivanje donje granice eksplozivnosti. Nakon toga, donja granica eksplozivnosti metanola i etanola je eksperimentalno utvrđena. Sva dva alifatična alkohola (kao što je methanol, etanol) se smatraju gorivima.*

Ključne reči: isparenja zapaljivih tečnosti, donja granica eksplozivnosti, metanol, etanol, alkoholna goriva, komora za sagorevanje (eksplozivna komora).

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COMPARATIVE ANALYSIS OF THE EFFECTS OF ORGANIZATIONAL CULTURE ON OCCUPATIONAL SAFETY AND HEALTH AT WORK SYSTEM IN BUSINESS ORGANIZATIONS IN SLOVENIA AND COMPANIES IN SERBIA

Abstract: *Occupational safety and health are important components of any developed society. There are two main reasons which indicate that - care for the workers' health and reducing costs of occupational injuries as a way of achieving additional cost savings and higher profits. Both workers and executives have very important roles in creating safe working conditions. The way that they understand certain norms and rules of conduct, largely creates preconditions for fulfilling or non-fulfilling the defined goals. The organizational culture of each organization consists of a set of certain values and norms that the members of a certain organization have developed and adopted and which determine their behavior in the course of work activities. Occupational safety and health is largely regulated through the values, norms and attitudes that employees have toward their work and work environment.*

The aim of this paper is to provide a comparative analysis of the research results conducted in Slovenia and Serbia on the basis of identical questionnaires for investigating the relationship of workers in both countries to the values of organizational culture related to occupational safety and health. The main hypothesis is that the impact of executives on the values of organizational culture related to occupational safety and health is of great importance to the manner of conduct of other workers in both countries. Appropriate descriptive statistical methods, factor analysis, linear regression analysis and other statistical methods were used to process the results.

Key words: organizational culture, occupational safety and health, safety culture.

INTRODUCTION

Every day, the economy of all countries is faced with numerous challenges that influence the functioning of all business organizations. Open markets, brutal competition in the domestic and foreign markets and continuing struggle for each customer requires continuous monitoring of all changes and their active management. The changes are an integral part of daily activities of all organizations, and it is not unknown that today organizations must run in order to stay in place. This statement reflects the intensity of changes at its best. It is clear that the costs of injuries are a big expense for both businesses and national economies. Injuries usually occur due to inadequate tools, disobeying defined procedures for safe operation and human error. Nowadays, work tools mostly comply with the standards that allow safe operation. More and more factories produce work tools that have been brought in their constructive phase into the state where their exploitation reduces injuries to the fullest extent possible. Consequently, we can claim that those tools are safe for operation. Taking into account many circumstances that can lead to injuries, the ability of workers to influence the specific work processes or activities, adequate training for safe operation and similar, it has been believed that a lot of responsibility for the current situation is generated by inadequate organizational culture. In order to make significant progress towards reducing the number of accidents, it is necessary to determine why workers behave in a certain way, what affects their behavior and who influences the creation of a system of values in an organization.

Organizational culture with a certain system of values is brought to an organization by a founder, while the executives are in charge of the implementation of defined values. According to this, we can conclude that the attitude of executives toward promoted values of organizational culture generates the attitude of other workers in the organization. Due to this fact, there is a growing number of scholars and practitioners engaged in studying the organization itself and organizational culture as well.

THE CONCEPT OF ORGANIZATIONAL CULTURE

Organizational culture has become the object of research of both theoreticians and practitioners, after the Japanese boom in international markets [1]. It is evident that the quality of Japanese products is not debatable, but what has become a subject of interest is the attitude of their employees toward their organization. A large number of scholars have noted that some nationalities have different attitudes towards certain values. Thus, comparison of certain values has showed that there are huge differences between employees' attitudes towards the organization (e.g. in Japan and the U.S.A). The importance of national culture in perceiving a certain system of values has become known to a famous researcher Geert Hofstede, who has done the research on the impact of national culture in the period 1967-1973. This study has involved the former Yugoslavia. Hofstede has defined four basic dimensions characterizing national cultures, based on his research [2]: distance of power, avoiding uncertainty, individualism / collectivism, and masculine / feminine values. Any generalization in interpreting certain positions is not always desirable, but numerous studies have confirmed that certain values in national cultures have a completely different dimension [3]. Therefore, it is necessary to have these facts in mind when the organization attempts to create an ideal organizational structure. This question becomes particularly evident in times of open markets, impact of specific national cultures in a very narrow field. Consequently, managing multicultural organizations can be a real challenge for any executive and requires a lot of work and knowledge of specific circumstances that may determine the manner of behavior of certain members in the organization. It is becoming increasingly clear that without synchronizing culture of specific groups and the activities that should take place in an organization, long-term economic stability and profitability cannot be achieved. There are many definitions of organizational culture. One of generally accepted ones in our region defines organizational culture as a system of assumptions, values, beliefs and norms of behavior that members of some organizations have developed and adopted through a shared experience manifested through symbols which is directing their way of thinking and behavior [4]. Moreover, the definition of organizational culture defining it as the sum of a scope of ideas, concepts, customs, traditions, procedures and habits of action in a separate macro-culture can also be interesting [5]. By analyzing the above mentioned and other definitions, it is noted that most definitions have the same or similar values in the focus of their observation. Based on this, we can conclude that creating a system of values, norms of behavior within an organization, creates preconditions for an increase in business competences of the organization itself. The process of developing a specific organizational culture requires some adjustments. Without adjustments, and the desire to change certain attitudes and values, it can be difficult to create a good organizational culture that encourages growth and development of the organization and increases productivity in all business segments in it. Certain values, attitudes and norms in an organization are created in the process of evaluating current situation and the desire to improve it. All problems which arise in this process can be classified into two groups: internal and external adjustment. External adjustment is based on the fact that some changes that occur in the immediate vicinity affect the development and growth of the organization and it is necessary to make some changes periodically to keep pace with competitors. Some of these changes in the environment are easily visible and some are hardly visible. Any changes in the organization that are carried out due to external adjustment involve internal acceptance by the organization members. Once defined and established attitudes are difficult to change and require considerable time. It is therefore essential that managers try as much as possible to anticipate some changes and move forward in order to meet them in an attempt to change certain values in their organization before the others and thereby achieve certain benefits. Every organization strives to create a specific organizational structure that will allow it to react adequately to any changes in their environment.

As we have already mentioned, the founder is the one who brings basic system of values to the organization. Values are then being transferred to the other members of the organization through the executives of certain organizational units. The process of transferring a certain system of values is a very complex issue and requires some time and active management of the process. The executive of a certain organization, or its part, is someone who has all the resources at his disposal that can affect creating a particular organizational culture in that organization. The question of resources, methods of their use (affirmative and repressive methods to "stimulate" the acceptance of defined goals) largely determine the time of accepting declared values. The first step in defining target values of an organizational culture implies a clear analysis of the current state. Executives can not have big ambitions and set unrealistic goals, especially in the short term, to the members of their organizations without evaluating current situation. Executive behavior affects the conduct of organization members in a significant way. If executives act in accordance with the promoted values, the other members of the organization will accept certain changes easily. Time in which employees will accept certain changes is of great importance. We have already stressed the importance of anticipating certain changes indicating a need to change certain attitudes and values as quickly as possible. Both repressive and affirmative actions are available to the executives. We would like to give advantage to affirmative measures as those create better prerequisites for understanding the essence in the long

run and the need to actively adjust certain values to new circumstances. Repressive measures solve the problem in the short term but as long as all organization members do not understand why it is necessary to change some of their attitudes or values, a rapid adaptation to changes in the environment can be hardly expected. Leaders shape the culture of an organization and the culture of an organization shapes a leader [6].

OCCUPATIONAL SAFETY AND HEALTH

If we go back many years and centuries, we can see by a number of documents and items that the field of occupational safety and health has always been present in social life. In some periods, it was more significant than in the other periods. Regardless of the period, it is clear that position of workers has gradually improved through years. At the first stage, it was through gradual work organization in a way that human power was used less and it was replaced wherever possible. The next phase is characterized by production of work tools that reduced the possibility of occupational injuries with their design characteristics. The third period refers to the gradual inclusion of all factors in an organization in creating safer working conditions. In this sense, certain normative activities appeared in the course of history. They have evolved over time and through certain legal acts sought to create working conditions in which there would be less occupational injuries. Most countries in our environment have passed new laws regulating occupational health and safety field and they are largely harmonized with the EU normative acts which all the countries of the region aspire to. The law defines this area and a number of secondary legislation (regulations, instructions etc.) define all business areas more precisely. The Republic of Serbia passed the Law on Occupational Safety and Health in 2005 [7] thus returning the topic of occupational safety to the focus of interest of many business entities. The Law and other normative acts define certain obligations and responsibilities of all factors in a business process. The law defines not only rights and obligations of the executives but also rights and obligations of workers. Occupational safety and health field is of great importance for the development of each national economy and therefore all organizations that make a country. Human aspects of occupational health and safety are implicit and it is clear to everyone that human life is priceless, and that insistence on this area is clearly rooted in fundamental social relations. What is particularly interesting and sheds particular light on this matter is the cost of occupational injuries. The society itself bears a certain cost of injuries whereas every employer whose employee suffers occupational injury bears a significant share. Tangible and intangible damage for the workers who have suffered injury will not be specifically treated in this paper, but we will imply it and give it an extra dimension. The research conducted by the International Labor Organization has found that the expenses of occupational injuries cost each national economy cca. 4% of GDP [8]. This fact itself indicates great importance of this matter and necessity for all structures of society to get involved in reducing this percentage. If we return to the current state, great economic crisis, GDP growth rates, which in most national economies are stagnating or declining, it is clear that there are certain provisions in the field of occupational health and safety organization. If we begin with abstract fact that there were no injuries, each national economy with zero growth rate would therefore have cca. 3 to 4% growth rate. It is still an impossible scenario because injuries happen and will happen in spite of all possible safety measures. However, reducing the number and severity of injuries for a half or a quarter leaves considerable scope for increasing competences in a society as a whole.

In the process of creating a secure working environment we are facing two groups of factors that greatly influence the attitude towards occupational safety and health: attitudes of both employers and employees toward occupational health and safety. Most employers see their obligations regarding creation of safe working conditions as an expense rather than as an investment. As long as there are no injuries in their organization, they cannot change their attitude towards occupational safety which in some situations causes enormous costs. Another important factor that influences the attitude towards occupational safety is the attitude of the employees themselves. Their attitudes, system of values, norms of behavior can significantly improve or downgrade any organization. Thus, we come to organizational culture which in an organization defines certain system of values, norms and behaviors that employees have toward occupational safety and health.

ORGANIZATIONAL CULTURE AND OCCUPATIONAL SAFETY AND HEALTH

Linking organizational culture and occupational health and safety leads to the creation of a particular culture or safety culture. The concept of safety culture, culture of occupational safety, is associated with the incident at Chernobyl by the majority of researchers, when the explosion occurred in a nuclear power plant. Consequences of that incident have not been fully determined even today.

In 1986, International Atomic Energy Agency revealed poor safety culture in the plant to the whole Russian society as the cause of the incident happenings. Several incidents thereafter Piper Alpha, Ladbroke Grove, Kings Cross, and the last accident in the nuclear power plant in Japan, partly indicate poor safety culture as the cause of incidents.

The following figure illustrates the influence of organizational culture on each organization.

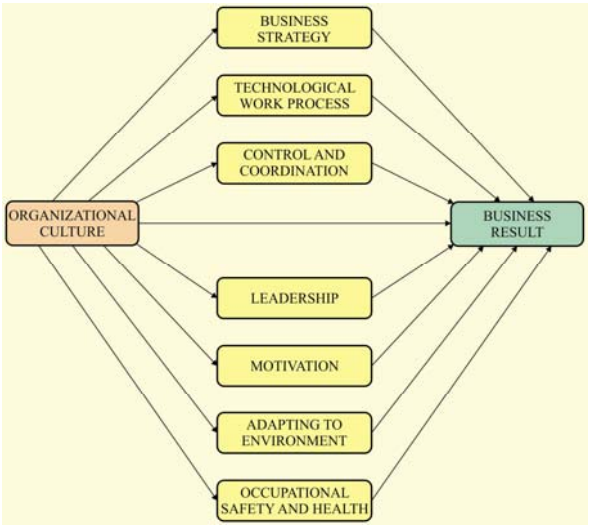

Figure 1. *The influence of organizational culture on business result*

Each action has its reaction. Treating causes is always better and more cost-effective than treating effects. In this sense, it is necessary to strive toward creating certain values of organizational culture that will respect the importance of occupational safety and health. The moment employees realize that obeying certain rules of occupational safety and health is in their interest, we have made a significant step towards creating a safe environment. Organizations which have managed to create a situation with clear understanding of the importance of safety are those which create conditions for a clearer presentation of certain norms of behavior, attitudes, and values. With active participation of direct initiators employees will gradually understand why it is insisted on certain values, attitudes and norms. The next stage in understanding the importance of occupational safety involves creating relationship of creativity in which employees are actively involved in observing and analyzing certain values or attitudes in order to improve current situation. Development of specific subcultures is necessary in order to provoke creativity of employees constantly and make them strive for creating safer working conditions. Employees who perform certain jobs know best potential dangers and hazards they are exposed to in the course of work activities. Development of their awareness that they represent a significant factor in a working process and that they are requested to involve themselves with specific proposals and suggestions is one of the best preconditions for making safe working environment in the long run.

ORGANIZATIONAL CULTURE RESEARCH IN SERBIA AND SLOVENIA

The basic requirement for creating awareness about the importance and influence of organizational culture on occupational safety and health system is based on the need of organizing a large number of studies. Only exact research and set results can create good theoretical preconditions for educating all members of society about the importance of this matter. Organizational culture was in past evidently the subject of sufficient interest to practitioners and theorists. A review of the available literature revealed that organizational culture was very rarely in the focus of research and beside a couple of studies of organizational culture within large organizations and a few studies dealing with the main characteristics and influence of national culture on organizational culture, there are no significant studies of organizational culture itself. As a pretty interesting study, we could mention the study of organizational culture that was conducted by Human Synergistics Serbia in Belgrade in 2010. Wider results of this study are not yet accessible to the public. Unlike Serbia, the situation is slightly different in Slovenia. There are a number of papers in Slovenia dealing with determining relationship between organizational culture and occupational health and safety system. Thus, the paper - Organizational culture as an effective tool in managing occupational safety [9] presents research results in an international production company. In addition to that research, we would like to single out the research undertaken within a master's thesis dealing with the role of leaders in the area of occupational safety and health [10]. Based on a questionnaire that has been structured in this paper, a research was carried out in Serbia and these two surveys have inspired us to create one paper that would analyze the attitude of respondents toward occupational Health and Safety in Slovenia and Serbia.

Methodology

The Questionnaire research consists of five separate units. The first part of the questionnaire relates to determining activities of the organization the study was conducted in. The second part of the questionnaire presents classical demographic data on the respondents: gender, age, total years of service, years of service in the organization they currently work for, education level, etc. The third part of the questionnaire refers to the number of accidents in the past five years. The fourth part deals with determining attitudes of workers toward occupational safety issues. The law governing the area of occupational safety in Slovenia has been effective for a long time. It will be interesting to compare the attitude of employees in Slovenia to the attitude of employees in Serbia, since the Law on Occupational safety and health in Serbia was passed seven years ago. The fifth part of the questionnaire is the most demanding and it requires from the respondents to answer and define their attitude toward certain values of organizational culture in relation to occupational safety and health. This part studies the attitude of employees and executives toward defined criteria, such as vision, credibility, cooperation, feedback, respect, responsibility, communication and orientation to take action. The research sample in Slovenia included 62 respondents in 62 organizations. The research sample in Serbia was comprised of 801 respondents in 73 organizations. Appropriate

descriptive statistical methods, factor analysis, linear regression analysis and other statistical methods were used to process the results.

RESULTS OF COMPARATIVE ANALYSIS OF THE EFFECTS OF ORGANIZATIONAL CULTURE ON BUSINESS ORGANIZATIONS IN SERBIA AND SLOVENIA

The research sample in Slovenia included executives, whereas the research sample in Serbia included 20% of executives and 80% of workers. There were 159 respondents who were executives in their organizations in the study sample in Serbia.

In the next part, we will show some of the test variables of organizational culture and respondents' opinion in Slovenia and Serbia.

Table 1. *The research results of the respondents' opinions of the test variable VISION in Slovenia*

VISION	Average response value	Standard deviation σ
I show high personal standard in relation to safety and health.	5.94	1.55
I help others to start their own thinking of personal standards in relation to safety and health.	5.18	1.58
I convey a vision by personal behaviour and words.	5.84	1.47
I am open to new ideas.	6.52	1.11
I encourage others to think about the influence of personal actions on themselves and others in the organization.	5.60	1.51
I encourage employees to accept challenges related to values connected with S&H.	5.55	1.61
I definitely know how to define a framework of action in future.	5.45	1.51

Table 2. *The research results of the respondents' opinions of the test variable VISION in Serbia*

VISION	Average response value	Standard deviation σ
I show high personal standard in relation to safety and health.	5.29	1.86
I help others to start their own thinking of personal standards in relation to safety and health.	4.95	1.93
I convey a vision by personal behaviour and words.	4.91	1.92
I am open to new ideas.	5.71	1.60
I encourage others to think about the influence of personal actions on themselves and others in the organization.	4.47	2.11
I encourage employees to accept challenges related to values connected with S&H.	4.35	2.19
I definitely know how to define a framework of action in future.	4.76	2.07

If we look at the average response values, we can determine that respondents in Slovenia generally have a better attitude towards the VISION as a variable that affects attitude toward occupational safety and health. If we ignore differences visible in total values and pay attention to individual values, we can come to some interesting conclusions. Respondents in Slovenia and Serbia achieved the highest value of all offered questions on the one defining openness to new ideas. This is a good indication showing a good ground for innovation in the field of occupational safety. Potential problem is the attitude towards the issue of encouraging employees to accept challenges in the field of occupational safety that has very little value with respondents in Serbia in contrast to respondents in Slovenia.

This information shows direction executives should be operating on in Serbia and what to pay special attention to. Given that the maximum value is seven, obtained responses are quite good. Interesting variable is a variable of CREDIBILITY that shows how respondents evaluate themselves.

Table 3. *The research results of the respondents' opinions of the test variable CREDIBILITY in Slovenia*

CREDIBILITY	Average response value	Standard deviation σ
I admit personal mistakes in front of others.	5.45	1.61
I always give accurate information, although they may be negatively received.	6.56	1.07
I support the others in relation to the higher level.	5.50	1.51
I seek suggestions and ideas for personal improvement.	6.08	1.50
I correctly perform the prescribed standards.	6.47	1.16
I accept risky and unpopular decisions that may harm personal career, but that are useful to employees in terms of S&H.	4.82	1.73
I treat people with dignity and respect.	6.85	0.65
I always fulfill given promises.	6.51	1.12

Table 4. *The research results of the respondents' opinions of the test variable CREDIBILITY in Serbia*

CREDIBILITY	Average response value	Standard deviation σ
I admit personal mistakes in front of others.	5.52	1.74
I always give accurate information, although they may be negatively received.	5.21	2.13
I support the others in relation to the higher level.	4.61	2.10
I seek suggestions and ideas for personal improvement.	5.43	1.77
I correctly perform the prescribed standards.	5.88	1.55
I accept risky and unpopular decisions that may harm personal career, but that are useful to employees in terms of S&H.	4.11	2.12
I treat people with dignity and respect.	6.47	1.18
I always fulfill given promises.	6.21	1.37

Similar to the previously tested variable of vision, it is evident that both groups have the highest values in the area of behavior and respect for other people. At the same time both groups rarely opt for solutions that could bring them potential problems, even if these solutions are good from the standpoint of improving occupational safety and health.

COOPERATION of all factors in a business process is also essential for creating safe working conditions. In

the following tables we will see how this variable is experienced by respondents in Slovenia and Serbia.

Table 5. *The research results of the respondents' opinions of the test variable COOPERATION in Slovenia*

COOPERATION	Average response value	Standard deviation σ
I promote cooperation related to S&H.	5.55	1.51
I examine and encourage employees to improve issues related to S&H.	5.35	1.51
I help others in encouraging them to solve challenges related to S& H on their own.	5.16	1.57
I encourage adoption and implementation of new solutions.	5.98	1.43
I am ready to listen.	6.56	1.07
I trust in others.	5.74	1.49
I support independent decisions of others.	6.08	1.39
I ensure compliance of others prior to implementation of innovations.	5.40	1.51

Table 6. *The research results of the respondents' opinions of the test variable COOPERATION in Serbia*

COOPERATION	Average response value	Standard deviation σ
I promote cooperation related to S&H.	4.75	2.03
I examine and encourage employees to improve issues related to S&H.	4.26	2.10
I help others in encouraging them to solve challenges related to S& H on their own.	4.59	2.00
I encourage adoption and implementation of new solutions.	4.59	2.13
I am ready to listen.	6.09	1.51
I trust in others.	4.79	1.90
I support independent decisions of others.	5.16	1.69
I ensure compliance of others prior to implementation of innovations.	4.51	1.97

Looking at research results for this variable, we notice that the highest values relate to employees' willingness to listen. It is good on one hand, but on the other hand, active involvement of all employees in the work processes and making suggestions and proposals that will create conditions for a safer working environment is of great importance according to the authors.

It is interesting that respondents in both countries have very high values related to degree of support to others to make independent decisions. This could be interpreted in both countries as a reluctance to take responsibility for decisions that were made. The lowest values in respondents in Slovenia are for issues dealing with the need to help other employees to accept certain standards and promote cooperation as a way of creating better working conditions. The lowest values in respondents in Serbia suggest a lack of desire to be in mutual cooperation with other employees in order to improve production process and create safe working conditions.

FEEDBACK is the key for redefining adopted strategies and decisions. Each executive must be aware that good feedback enables correcting decisions and increases business competencies of the organization itself. Next section will show how respondents in Slovenia and Serbia see feedback.

By looking at research results in both countries, we observe certain rules again. The rule is that respondents in both countries show the highest values in the part concerning public recognition of other participants' contributions to working process and whose work has made significant steps forward in terms of creating a safer and more secure work environment. At the same time we notice that both groups are not too interested in celebrating success related to occupational health and safety.

Table 7. *The research results of the respondents' opinions of the test variable FEEDBACK in Slovenia*

FEEDBACK AND APPRECIATION	Average response value	Standard deviation σ
I publicly acknowledge contribution of others.	6.37	1.23
I immediately give credit to people who have contributed to improving S&H in the company.	5.87	1.47
I encourage positively and not criticize attempts.	5.67	1.50
I give positive feedback and reward successfully implemented measures.	5.67	1.50
I motivate all in the company.	5.70	1.50
I celebrate success related to S&H.	4.15	2.02

Table 8. *The research results of the respondents' opinions of the test variable FEEDBACK in Serbia*

FEEDBACK AND APPRECIATION	Average response value	Standard deviation σ
I publicly acknowledge contribution of others.	5.84	1.66
I immediately give credit to people who have contributed to improving S&H in the company.	5.74	1.73
I encourage positively and not criticize attempts.	5.55	1.74
I give positive feedback and reward successfully implemented measures.	5.59	1.79
I motivate all in the company.	4.57	2.14
I celebrate success related to S&H.	4.08	2.31

Liability of employees and executives to create a safe work environment is great. Laws and secondary legislation clearly define the liability to create safe and secure work environment for both employees and executives. It is therefore very important to raise an awareness of increasing responsibility while performing certain activities, both toward one's own self and the other employees with whom they share the same workspace.

In the next part, we will show how the respondents assess RESPONSIBILITY and willingness to influence creation of a safe work environment. The final result of a secure environment is fewer accidents which is a goal of both employers and employees.

Taking into account the research, we notice similar attitudes and evaluations of individual claims. Thus we note that the highest values in both groups are given to demands for responsibility for delegated tasks. Generally, both groups of respondents have greater values in the domain of insisting on responsibility for taken actions and lower values for analyzing defined goals and readiness to implement certain changes. Identical trends are observed in other examined variables.

Table 9. *The research results of the respondents' opinions of the test variable RESPONSIBILITY in Slovenia*

RESPONSIBILITY	Average response value	Standard deviation σ
I define roles in the company clearly and transparently.	5.89	1.46
I promote a system that supports individual responsibility for their own work place.	6.56	1.07
I define responsibilities for tasks related to S&H.	5.79	1.58
I demand individual responsibility for accepted jobs.	6.27	1.30
I define criteria for set goals.	5.77	1.59
I analyze the achieved results on the basis of defined criteria.	5.74	1.49
I implement changes.	5.77	1.49

Table 10. *The research results of the respondents' opinions of the test variable RESPONSIBILITY in Serbia*

RESPONSIBILITY	Average response value	Standard deviation σ
I define roles in the company clearly and transparently.	5.15	1.97
I promote a system that supports individual responsibility for their own work place.	5.32	1.97
I define responsibilities for tasks related to S&H.	4.99	2.08
I demand individual responsibility for accepted jobs.	5.50	1.89
I define criteria for set goals.	4.94	2.11
I analyze the achieved results on the basis of defined criteria.	4.52	2.10
I implement changes.	4.65	1.99

It is interesting to compare the part related to understanding of occupational health and safety, investment in this area as well as educational needs. The table 11 shows that most respondents in Serbia understand what occupational safety is. However, final warning is the fact that very few respondents understand legal requirements for occupational safety and health and do not evaluate properly the need for education in this area.

Table 11. *Average responses to claims related to occupational safety in Serbia*

CLAIM	AS	SD
I understand legal requirements as	2.54	1.92
Investments are	4.12	2.27
Occupational safety is	5.03	1.77
Education for occupational safety is ...	3.87	2.70

Research in Slovenia has shown somewhat higher value in the area of investment for occupational safety and necessity of education. However, just like in Serbia, a significant number of respondents in Slovenia have doubts about understanding legal basis and obligations for both employers and employees. Achieved values with respondents in Slovenia are on all claims generally higher. The reason for this is the fact that Slovenian respondents were mainly executives and Serbian subjects were workers and executives (20% of research sample consists of executives and 80% of workers). Bearing in mind that presented claims were intended to be indicators of certain aspects of organizational culture, that is, indicators of attitude toward occupational safety, we started checking whether they met requirements of the latent model, or whether they could really be considered as indicators of a certain latent trait. In case they were adequate indicators then a special one-factor solution should prove as the most adequate during factor analysis process of each group of claims. After factor analysis, we found that displayed factor saturation of each claim from the group met Gutman-Kaiser criterion as well as their intrinsic value.

The results have shown that it is justified to combine respondents' replies to appropriate claims in order to obtain values of expressiveness of relevant aspects of organizational culture among respondents in the sample. This is done by calculating average values of respondents' answers to claims indicating corresponding aspect of organizational culture. After calculating descriptive statistical measures, as well as the formation of composite scores of attitudes towards occupational safety and aspects of organizational culture, we examined relationships between attitude toward occupational safety and other examined characteristics, as well as between other aspects of organizational culture. The results shows that correlations between aspects of organizational culture are quite high, ranging from 0.63 to 0.81, which may indicate that there is one common factor in the essence of each of them. Therefore, we did exploratory factor analysis by analyzing principal components over these measures. If we compare our results with the results of a study conducted in Slovenia, we see that the factor that has been obtained generally corresponds in its structure to the factor, which in the research in Slovenia has been called the usefulness of management. This is a general factor that has high saturation on all aspects of organizational culture. Compared with that research, the factor extracted from this sample explains a higher percentage of variance of organizational culture aspects (almost 78% versus 58% obtained there) and, consequently, more saturation for all aspects of organizational culture. Taker congruence coefficient between this factor structure in this research and the structure of the same factor in the above mentioned reference study is 0.998, which definitely indicates that they are completely equivalent factors. Accordingly, we can state the presence of identical factor that confirms that the manner of managing an organization is very important and greatly contributes to creating a safe environment to work in both in Slovenia and Serbia. When we included other factors into the analysis, such as: qualifications, gender, type of job, we have found that the impact on occupational safety and health is realized through organization management. Thus, once again it has confirmed the importance and role of managers in relation to organizational culture and organizational culture variables related to occupational health and safety.

CONCLUSION

Taking into consideration the obtained results, we can conclude that impact of executives on creating a safe work environment in Slovenia and Serbia is very significant, which confirms our initial hypothesis. Accordingly, we can conclude that top management of each organization has a great challenge to harmonize individual attitudes and values with declared values. What is of particular importance is the need for continuing education that will create clear preconditions for defining key values and strategies. The next step is to define methods and techniques which will help managers create conditions for implementing the defined strategy. Important role in this process is given to motivation of workers and willingness to change their attitudes and values, giving priority to collective versus the individual. In order to improve the organization by understanding the importance of occupational safety and health, there must be a clear strategy and target culture which entire organization aspires to. If management in an organization does not have a clear strategy in relation to occupational safety, it cannot be expected from the employees to have a clear system of values that guide their everyday work in the field of occupational safety.

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KOMPARATIVNA ANALIZA UTICAJA ORGANIZACIONE KULTURE NA SISTEM BEZBEDNOSTI I ZDRAVLJA NA RADU U POSLOVNIM ORGANIZACIJAMA U SLOVENIJI I PRIVREDNIM DRUŠTVIMA U SRBIJI

Živković Snežana, Todorović Miliša, Markič Mirko

Abstrakt: *Bezbednost i zdravlje na radu predstavlja veoma važnu komponentu svakog razvijenog društva. Dva osnovna razloga ukazuju na to: briga za zdravlje radnika i smanjivanje troškova povreda na radu kao način za ostvarivanje dodatnih ušteda i ostvarivanje većeg profita. Najvažniju ulogu u procesu stvaranja bezbednih uslova za rad imaju kako radnici tako i rukovodioci. Način na koji oni shvataju određene norme, pravila ponašanja, u velikoj meri stvara preduslove za ostvarivanje ili neostvarivanje definisanih ciljeva. Organizacionu kulturu svake organizacije čini skup određenih vrednosti i normi koji su članovi neke organizacije razvili, prihvatili i koje opredeljuju njihovo ponašanje u toku obavljanja radnih aktivnosti. Bezbednost i zdravlje na radu u velikoj meri se reguliše kroz vrednosti, norme i stavove koje zaposleni imaju prema svom radu i radnom okruženju. Cilj ovog rada je da napravi komparativnu analizu rezultata istraživanja koja su sprovedena u Sloveniji i Srbiji, na osnovu identičnog upitnika, radi sagledavanja odnosa radnika u Sloveniji i Srbiji prema vrednostima organizacione kulture koje se odnose na bezbednost i zdravlje na radu. Polazna hipoteza rada jeste da je uticaj rukovodioca prema vrednostima organizacione kulture koje se odnose na bezbednost i zdravlje na radu od velikog značaja na način ponašanja ostalih radnika u obe zemlje. Za obradu dobijenih rezultata korištene su odgovarajuće deskriptivno statističke metode, faktorska analiza, linearna regresiona analiza i ostale statističke metode.*

Ključne reči: organizaciona kultura, bezbednost i zdravlje na radu, kultura zaštite na radu.

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MODEL OF OCCUPATIONAL INJURY INFORMATION SYSTEM AND KNOWLEDGE MANAGEMENT

Abstract: The aim of the research is the establishment of a comprehensive and consistent model of occupational injury information system and knowledge management, thus creating a precondition for the improvement of occupational safety system. Theoretically and practically applicable model of occupational injury information system and knowledge management has been established on the basis of the re-engineering of information processes of occupational injury reporting and analysis, as well as the possibility of application of modern information and communication technology, especially the Internet. The integrity of the model has been verified through simple inclusion of all elements, participants and other stakeholders as well as the general public in the system. The consistency of the model is confirmed by the uniqueness of occupational injury information system and knowledge management.

Key words: information system, knowledge management, model, occupational injury, occupational safety.

"Information and knowledge are the thermonuclear competitive weapons of our time."
Tomas A. Stewart

INTRODUCTION

Subject matter of research

Information can be viewed from different aspects, from the broadest philosophical to the narrow technical aspect, or in terms of information and communication technology [1]. Information is the result of data processing [2]. A central concept in the information science implies a certain amount of knowledge needed for a particular procedure, which is specifically not available. Thus, the information can be defined as "knowledge in action" but also as "the basic foundation for learning."

Information flow of the learning process begins with the analysis of the input information in relation to prior knowledge and set goal, and by reaching the conclusion, thus creating new knowledge or a better form of prior knowledge. New knowledge can be obtained from the environment or can be produced by deduction, induction or analogy. Information management is the process of converting information into knowledge through permanent storage of information. It is therefore necessary to comprise (what is technically a formal procedure) and organize (a procedure related to the content - the level of semantics) knowledge [3].

By the definition of the International Federation for Information Processing (IFIP), "an information system is a system that collects, stores, keeps, processes and delivers information relevant to the organization and society, so that they are accessible and usable for anyone who wants to use them, including management, customers, personnel and others." The importance of strategic management decisions concerning the information system is reflected in helping organizations to "capitalize on IT opportunities". The key decisions of information system strategic management include: reengineering, outsourcing, the legacy of the existing system, user/server architecture, group work, system integration and the Internet and new technologies [4]. According to [5], basic elements of the information strategy management are information strategy analysis and strategic choice. Information systems must support business operations at all levels of management and strive to integrate all business functions and processes, thus creating a unique "managerial information system", which connects transactional information systems with the lowest data level with information systems of higher levels for decision support and knowledge-based expert systems in modern "digital enterprises" [6].

According to [7], knowledge management is a "new opportunity level of the upcoming information technology" and it is manifested as an "effective realization, implementation and maintenance of organizational knowledge and collaborative business environment enabled by the application of advanced information technology, tools and methods." Unfortunately, the literature has not still provided universal and uniform definitions of knowledge management, thus it is advisable to observe this concept in a broader context" as a process through which an organization generates value of their intellectual property based on knowledge" [8]. To "generate" actually means to share knowledge among employees, departments and even other companies if that is in the interest of best results and practices. At the same time, the technology facilitates the application of

knowledge management, but it does not constitute knowledge management.
Besides technology, knowledge management involves people and processes as interconnected and overlapping parts with the ultimate goal of effective application of knowledge in decision-making situations. Hence the concept of knowledge management can be seen as "the ability to reach an information in a relatively short time that will enable everyone in the organization to make the best decision, whether it relates to market conditions, product, service, process, planned activities of competitors, or some other information (occupational safety) important for the success of the company [9].
According to [10], "occupational safety is a state which allows for a normal flow of business processes and functioning of business systems, and thereby better business results." Occupational safety can be achieved by implementing occupational safety policies and measures, provided that the necessary knowledge is acquired. Petersen [11,12,13,14] links scientific methods and managerial techniques to create 'safety management techniques' and based on the 'goal-oriented safety management concept' for the purpose of performing a 'safety system effectiveness analysis' in accordance with the laws of economy and principles of management establishes 'standards for monitoring safety system performance'.
Occupational injury data are key performance indicators used to measure safety in business systems, industry branches, regions and countries. The analysis of occupational injury data is a precondition for acquiring knowledge and developing new occupational safety rules [15, 16].
Upon analyzing the procedure followed in occupational injury reporting in Croatia, [17] have concluded that "the computerization of the occupational injury recording and reporting system will set the basic preconditions for ensuring good data quality and reliable medical statistics". After gathering and measuring such data, problems will be more detectable and it will be easier to intervene in the working process in order to prevent occupational injuries based on the acquired data [18, 19, 20]
That is exactly why the existing system of occupational injury recording and reporting in the Republic of Croatia requires urgent modification.

Research problem

A problem of the incompleteness and inconsistency of occupational health and safety information systems and knowledge management can be identified, which is neither in compliance with theoretical (scientific) settings of information systems and knowledge management, nor with possibilities of the contribution of modern information and communication technology. That is the issue of business system management, but also of the overall occupational safety system in Croatia.

Objective

The research aims to contribute to the improvement of occupational health and safety system by modelling a comprehensive and consistent, science-based model of occupational health and safety information systems and knowledge management.

MODEL OF OCCUPATIONAL INJURY INFORMATION SYSTEM AND KNOWLEDGE MANAGEMENT

Systems analysis of occupational safety system

Systems analysis of occupational safety system is based on: 1) theoretical (scientific) bases of occupational safety and its organization, 2) normative (legal) bases of the organization of occupational safety, and 3) occupational safety practice analysis.
Systems analysis of occupational safety system is based on: 1) theoretical (scientific) bases of occupational safety and its organization, 2) normative (legal) bases of the organization of occupational safety, and 3) occupational safety practice analysis.
The function of the system (F) incorporates the meaning of existence, goal, purpose and role of the system. The function of occupational safety system can be defined as the purpose of occupational health and safety, which is preventing work-related injuries (including prevention of occupational diseases and other work-related illnesses) and protecting working environment, with the aim of achieving maximum safety as a condition for normal operation of business systems and the entire social community. The basic function of occupational safety system is prevention.
Decomposing the system reveals three main subsystems (as organizational subsystems) of occupational safety systems with regard to their role and area of responsibility in the area of occupational safety system, including:
1) National subsystem of occupational safety system
2) Business subsystem of occupational safety system
3) Public subsystem of occupational safety system
The first (micro) level of occupational safety system management is achieved in the business sub-system of occupational safety system. This level is a central and key management level, because occupational safety is directly realized in the business system and business system management is responsible for the implementation of occupational health and safety, but also for the consequences of occupational injuries.
On the principles of systems and process approach, it is possible to decompose the occupational safety system from the perspective of the system management, as follows: management function (subsystem, a set of processes) → process (a set of actions and decisions) → activity (process step, action). In this way, three subsystems of management functions can be determined, including:
1) subsystem of occupational risk management
2) subsystem of occupational health and safety management

3) subsystem of occupational injury management

These managerial subsystems are interconnected by direct sequential links. The first level of occupational safety system management includes reciprocal links to all subsystems individually. A key significance can be given to the backlink between the subsystem of occupational injury management and the subsystem of occupational risk management that closes the system in a constant reversible cycle and provides necessary information and new knowledge for occupational risk assessment audit after which new occupational safety measures are established, in order to accomplish the objective of occupational safety system (constant improvement of the system by preventing occupational injuries). Based on that, a mathematical model of occupational safety system can be set, defined by the following formal expression:

$$\mathbf{S = \{R, Z, O\}} \quad (1)$$

S – occupational safety system management, R - subsystem of occupational risk management, Z - subsystem of occupational health and safety management, O - subsystem of occupational injury management.

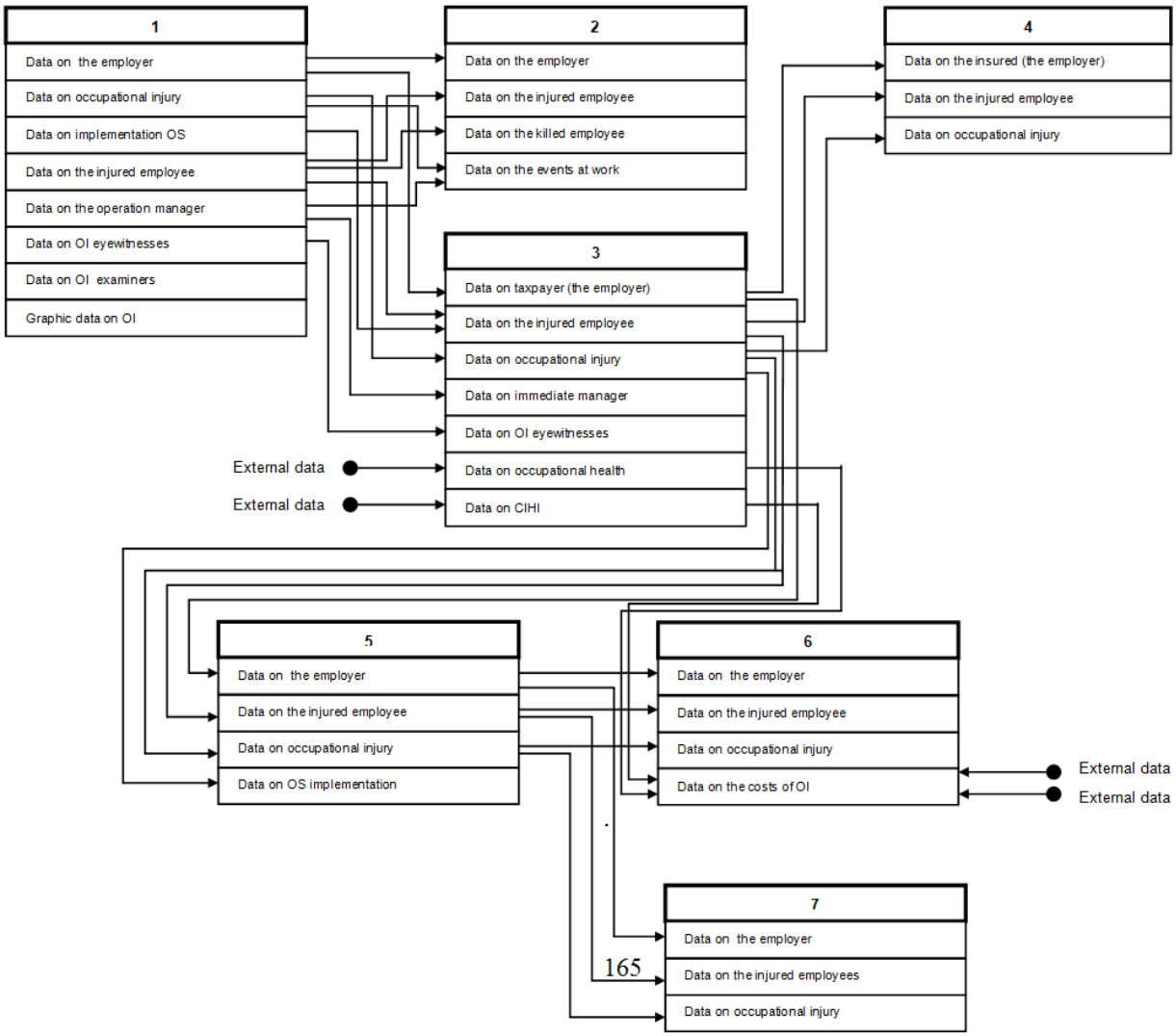

Figure 1. *Data model in the existing system of occupational injury information management*

Symbols:

1 - The record on examination of occupational injury

2 - The notification of an event at work that caused death, serious injury and injury of two or more workers, regardless of severity of injury

3 - The registration of occupational injury

4 - The registration insured event due to occupational injury

5 - The record board employees who are injured at work and on workers who are ill at work

6 - The calculation of costs (prices) of occupational injury

7 - The annual report on occupational injuries and occupational diseases of workers at work

OS - Occupational safety; OI - Occupational injury; CIHI - The Croatian institute for Health Insurance

Data model in the existing occupational injury information management system

Data model can be established based on data analysis in the existing occupational injury information management system. While the analysis was based on the existing documents containing specified information relating to occupational injuries occurring in the business subsystem of occupational safety system, general (conceptual) model contains a graphical representation of groups (classes) of data from these documents and relationship of data on occupational injuries in the business system (Figure 1).

The following main groups of data can be extracted from the total documentation system:

1) data on the employer (business system)
2) data on the injured employee (employees)
3) data on occupational injury
4) data on the implementation of occupational safety measures
5) data on the manager of operations during which injury occurred
6) data on occupational injury eyewitnesses
7) data on occupational injury examiners
8) data from occupational medicine and doctors on occupational injury
9) data from the Croatian Institute for Health Insurance
10) data on the costs of occupational injuries
11) other occupational injury data

The model clearly shows that the key data are generated during the process of occupational injury examination and recorded in a document entitled "Record of occupational injury examination". Other processes and their supporting documents use only these original data on occupational injury. Exceptions are the processes and reports on occupational injury and occupational injury cost calculation, which are using data generated from external systems or other internal systems in the business system.

Detailed analysis of the data shows:

a) Data incompleteness - because not all required data are included.
b) Data inconsistency - because time and logical and hierarchical relationships between data are inconsistent, along with the existence of discrepancies between data links.
c) Data redundancy - because data are repeated (copied) in the processes and documents.

In addition, data analysis shows irregularities in the classification and structure of data in the required documentation, which prevents direct application in the database. The original data on occupational injuries, which are generated in the business system, are also used by processes and users in government and public subsystem of occupational safety system for drafting statistical and other reports and information on occupational injuries on the public and national level of occupational information management. The problem of communicating data through prescribed written documents from the business system level towards macro levels of public and national system, as well as information backlinks, is specially emphasized.

Establishing strategic guidelines for improving occupational injury information system and knowledge management

The following strategic guidelines for improving occupational injury information system and knowledge management have been determined based on the analysis of the theoretical basis and analysis of the existing occupational injury information management system:

1) Integrity of occupational injury information system and knowledge management.

2) Consistency of occupational injury information system and knowledge management.

3) Reengineering of the existing information processes of reporting and analyzing occupational injuries.

4) Use of modern information and communication technology (ICT) in occupational injury information system and knowledge management.

5) Contribution of occupational injury information system and knowledge management to occupational safety enhancement.

Reengineering of information processes for the improvement of occupational injury information system and knowledge management

Reengineering of the existing information processes of reporting and analyzing occupational injuries is the basic precondition of the successful computerization and thereby the improvement of occupational injury information system and knowledge management, as well as the overall occupational safety system.

As determined by the current situation analysis, reengineering of information processes is possible and necessary, especially in the current process of document management in the existing occupational injury information management system. It will simplify administrative procedures and the number of separate documents, which is especially important for process computerization, and create conditions for data integrity and consistency and avoid redundancy of key data on occupational injuries.

Figure 2 shows the result of re-engineering. The beginning of such new process is an individual case of occupational injury of the employee in the business system that causes and generates data on occupational injury. During the first and crucial step of the procedure, occupational safety professionals in the business system collects all necessary and relevant data on occupational injury, which later can be used in other steps of the procedure. These data, which can also be in multimedia formats (digital photos, video, digital recordings of interviews, simulations, etc.), are stored in a computer database using ICT.

In the second step of the procedure, an occupation

injury is officially reported to the relevant state institutions. Occupational safety professionals use data from the database from the first step, which are also available to other participants in the process of occupational injury reporting. Occupational injury notification is submitted through the Internet, as well as all other necessary data. The course of the occupational injury notification process can be monitored through the Internet as well as its final status. The data on individual occupational injuries in business systems are stored in a single computer database of all occupational injuries in Croatia, which is kept by a competent and neutral government body (Croatian Institute for Health Protection and Safety at Work). The public portion of the data on occupational injuries is immediately available to all interested parties from business, public and national occupational safety system for the analysis and statistical reports, which makes the third step of the procedure. Data and information on occupational injuries gathered and processed this way are a professional foundation for the improvement of occupational safety by creating a repository of new occupational safety knowledge and measures, which includes all interested parties with the help of the Internet. That is also the last, fourth step in the reengineering of information processes of reporting and analyzing occupational injuries.

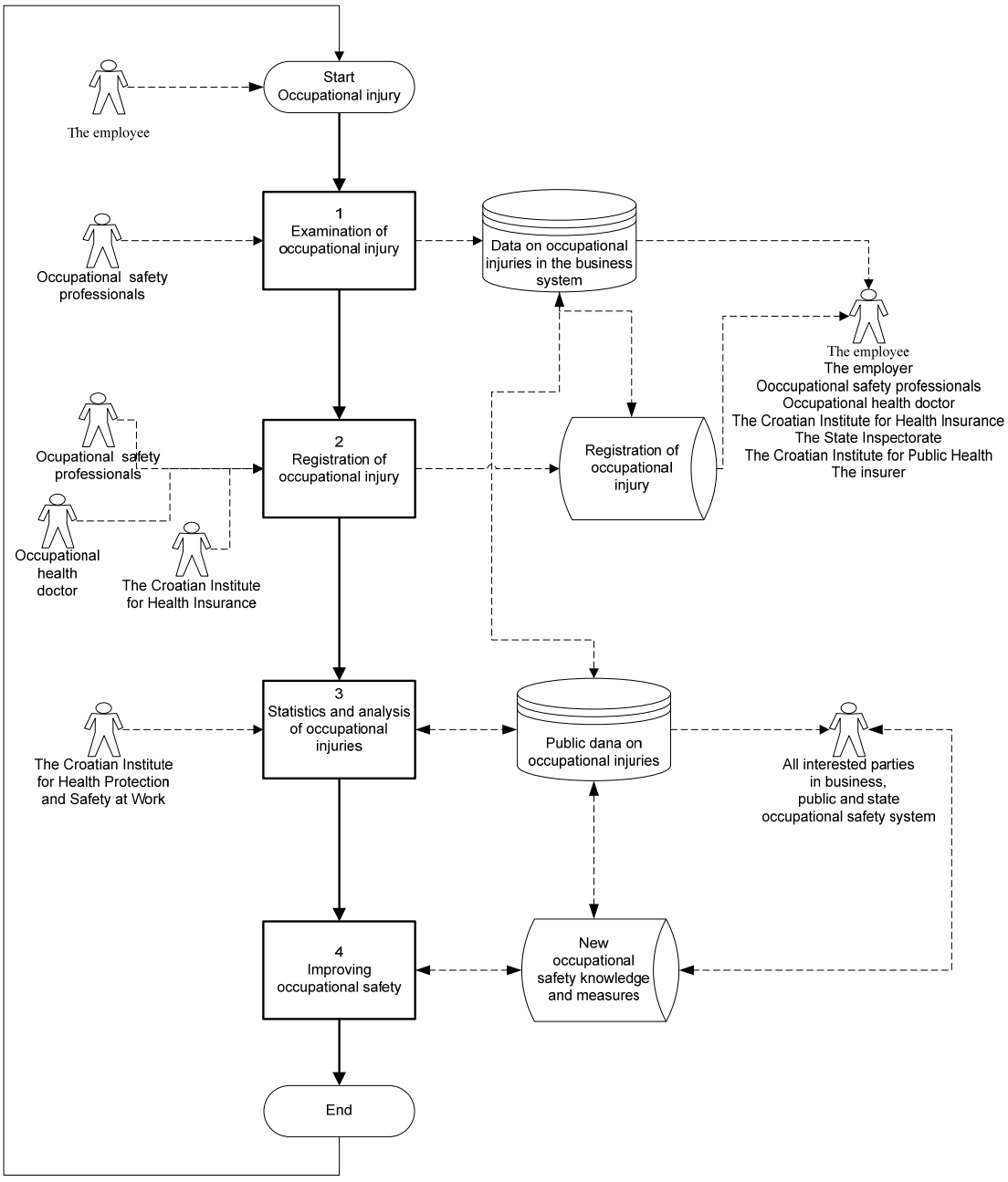

Figure 2. *Reengineering of information processes for the improvement of occupational injury information system and knowledge management*

Model of occupational injury information system and knowledge management

Following the completion of the information process reengineering, it is possible to establish a model of occupational injury information system and knowledge management, which is based on modern information and communication technology (Figure 3).

The information system has Network Computing Architecture, uses public Internet infrastructure, and essentially consists of a central computer database and web service and all licensed and authorized users from the business, national and public occupational safety system, as well as other interested parties and professional and general public.

A professional and independent state institution (Croatian Institute for Health Protection and Occupational Safety) is responsible for the management of the single and central occupational injury database and web service, and thus the entire information system. Such model of information system management, based on modern information and communication technology and Internet infrastructure can be characterized as the current trend of the information system "in the Cloud."

The complete computerization of processes and systems for reporting, recognition and analysis of occupational injury data is established by this model.

An authorized occupational safety professionals enters key data on occupational injury in the information system at the scene of injury in the business system. He/she may also use certain data from the existing business information system. Other participants from the business system involved in the process, primarily the employer and the injured employee, have the ability to access and view the data on occupational injury and reporting procedure.

A physician, that is, an occupational medicine practitioner has the ability to enter certain technical data on occupational injury, of which each has a unique identification number. The competent authority (Croatian Institute for Health Insurance) has the ability to modify the official data during the process of occupational injury recognition. Other participants (State inspectorate - occupational health and safety inspection, Croatian National Institute of Public Health and insurers) may also view the data and add their own specific data, once an occupational injury is officially recognized and verified.

Information on occupational injuries, primarily statistical analysis and data and new formalized knowledge and rules are available to all other interested parties and the general public through public access to the information system.

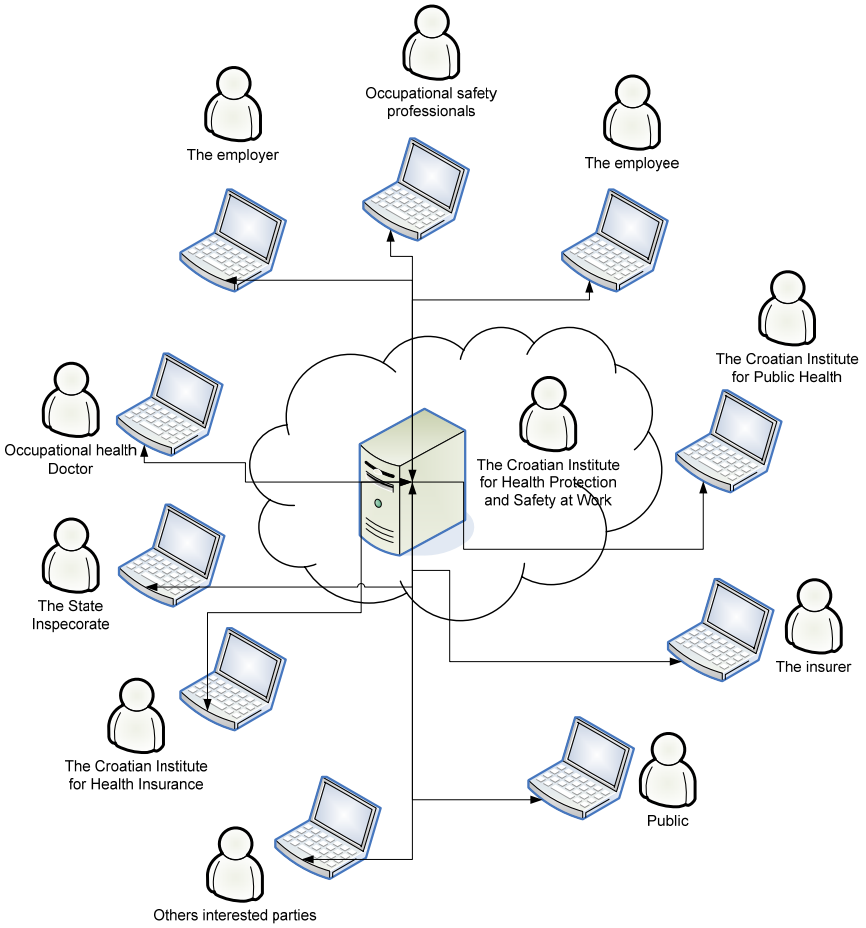

Figure 3. *Model of occupational injury information system and knowledge management*

CONCLUSION

Theoretically and practically applicable model of occupational injury information system and knowledge management has been established on the basis of the re-engineering of information processes of occupational injury reporting and analysis, as well as the possibility of application of modern information and communication technology, particularly the Internet. The integrity of the model is verified through simple inclusion of all elements, participants and other stakeholders as well as the general public in the system. The consistency of the model is confirmed by the uniqueness of occupational injury information system and knowledge management.

Any authorized, professional and independent state body can manage this model. In that way, all relevant occupational injury data entry can be implemented and monitored, only once at the site of the injury in the business system, as well as the subsequent procedures in the national and public occupational safety system. Only certain professional and authorized persons may enter these data. Such model of occupational injury information system and knowledge management can significantly contribute to the improvement of the overall occupational safety system, while it provides quality and timely information and new knowledge about occupational injuries that are crucial for decision support and effective knowledge management in the occupational safety system .

The aim of the modern organization is to observe all business processes as the beginning of knowledge. This includes the creation of knowledge, its expansion, improvement and application throughout the organization. Modern organizations are seeking ways to create additional value through the discovery and application of knowledge. Organizations and their managers should strive to create more explicit knowledge, which is collective by nature and cannot disappear when a person leaves an organization. Explicit knowledge contained in the bank of data, information and knowledge of an organization amounts between 10-20 %, and this part can be doubled by applying the concept of knowledge management [21].
As a further recommendation, it is suggested to conduct a large research on the use of ICT in occupational safety system, as well as research and development of detailed models of occupational injury and safety information system and knowledge management in Croatia, and their connection and compatibility with similar systems at the international level.

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BIOGRAPHY

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MODEL UPRAVLJANJA INFORMACIONIM SISTEMOM I ZNANJEM O POVREDAMA NA RADU

Josip Taradi, Zdravko Krakar, Vesna Nikolić

Rezime: *Cilj istraživanja je uspostavljanje celovitog i konzistentnog modela upravljanja informacionim sistemom i znanjem o povredama na radu kao značajne pretpostavke unapređenja sistema bezbednosti i zdravlja na radu. Teorijski i praktično primenljiv model upravljanja znanjem o povredama na radu uspostavljen je na temelju reinženjeringa informacionih procesa prijave i analize povreda na radu te mogućnosti primene savremene informaciono-komunikacione tehnologije, posebno Interneta. Celovitost modela potvrđuje se u jednostavnoj mogućnosti uključivanja u sistem svih elemenata, učesnika i zainteresiranih strana, pa i najšire javnosti. Konzistentnost modela potvrđuje se u jedinstvenosti upravljanja informacionim sistemom i znanjem o povredama na radu.*

Ključne reči: informacioni sistem, upravljanje znanjem, model, povreda na radu, zaštita na radu.

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EXPERIENCING STRESS AND STRESS SYMPTOMS AMONG SLOVENE MANAGERS

Abstract: *The aim of this study is to identify experiencing stress level at work, the stress symptoms frequency among Slovene managers, and to establish gender differences in terms of the intensity of experiencing stress symptoms. 85 middle level managers from Slovene companies of random choice participated in this study. The obtained data have been processed with SPSS 16.0 and the descriptive statistics, using frequency distribution and t-test data processing statistic methods to analyze them. The results of the study have shown that there are gender differences in terms of all the above mentioned factors, namely a statistically higher level of stress in women. In terms of stress symptoms occurrence, there are gender differences in some stress symptoms as well as in the intensity of experiencing stress symptoms.*

Key words: workplace, managers, middle level management, Slovenia enterprises, stress, stress symptoms, gender differences.

1. INTRODUCTION

1.1 Managerial stress

Higher working requirements, a lower degree of employment security and a changed life style impose a serious burden on an individual. Consequently, working under time stress and in a competitive environment may frequently result in cardiovascular diseases [1].

Workplace stressors which frequently cause problems with employees include unfavourable working conditions, working hours, nature of work, leadership style, working climate, career opportunities, harassment and workplace violence, intolerance and nature of organization, as well as noise, vibrations, dust, inappropriate temperature environment, lighting and hazardous substances. Occupational stress occurs most frequently as a result of inappropriate information policy, leadership styles, lack of competences, lack of trust, inappropriate working methods, forming a new post, inappropriate work standardization and hierarchy [2].

Nowadays most people hypothetically believe that company managers are the most affected group in terms of stress subjection. [3] claim that managerial stress may be a disease arising from careerism. However, despite their risky behaviour, managers are role models to many other professionals. Managers are heavily overloaded with various tasks and in turn held responsible for their decisions, which requires constant attentiveness, which may finally lead to unbearable stress. They may experience symptoms like insomnia, anxiety, fatigue, or even a serious illness (high blood pressure, angina pectoris, myocardial infarction, etc.). A very frequent illness in managers is an infarction, classified as a managerial disease. International Labour Organization recommends that diseases should be classified as occupational diseases.

Managers expect their work to be recognized and need to prove themselves successful. Therefore, they strive to be competitive. However, in the effort to stay competitive, managers may suffer from stress. As they may also fail in their attempts to become successful and often try to disguise the truth, such a situation may lead to depression. They become apathetic, lose enthusiasm and self-respect. Quite frequently they are convinced they experience physical illness symptoms when they are under stress and they most often try to relieve their tension by drinking alcoholic drinks to brighten their reality [4].

Managers from different countries perceive similar workplace stressors, which was also proved in a comprehensive international comparative study of occupational stress that collected data from 1065 managers in 10 countries (from 5 continents): Brazil, Great Britain, Egypt, Germany, Japan, Nigeria, Singapore, South Africa, Sweden and the United States. The most frequently listed workplace stressors, quoted with 55% of all respondents, were time pressure and tremendous work overload. Other frequent workplace stressors were long working hours, attending meetings, the conflicts between work and family and social relationships [3].

1.2 Stress Symptoms

A reaction to stress during short, manageable irritations (stressors) enables keeping an organism integrity (survival) and has a significant influence on its development – that is how we learn and adapt to irritations of a constantly changing environment. However, the same mechanisms that enable us to survive when we encounter danger, cause disease symptoms (like increased blood pressure and higher concentration of amounts of fat in blood, increase of waist circumference, fits of panics, depression) when we are exposed to a constant pressure of unmanageable stressors. Moreover, chronic stress (with its

characteristically prolonged and strong stress reaction) can increase the risk of worsening or developing health problems or diseases we are prone to, but they have not developed yet (e.g. asthma, allergy, headaches, diabetes, and angina pectoris) [5].

The most frequent stress (stress-related disturbed balance) symptoms are [6]:

1. Physical stress symptoms:

- insomnia or excessive sleepiness
- decreased or excessive appetite, nausea, indigestion
- pains in muscles, chest or around the heart
- frequent headaches, dizziness
- chronic fatigue, lack of energy or energy burst followed by depression
- frequent colds, allergies
- excessive consumption of nicotine, caffeine, tranquillizers, alcohol, etc.

2. Mental stress symptoms:

- anxiety, restlessness, tension, apprehensiveness
- dissatisfaction, bad mood, irritability
- low spirits, feeling helpless and desperate, depression
- oversensitiveness, confusion, sudden changes of mood
- nightmares, frequent crying
- rises and failures of self-respect, feelings of inferiority

3. Interpersonal relationship stress symptoms

- wish for solitude, keeping from other people, isolation
- communication problems
- less frequent socializing
- distrust, impatience
- sex disturbances

4. Occupational stress symptoms:

- feeling overloaded, low productivity, loss of direction
- lack of interest for activities that used to amuse you;
- lack of new ideas, indecision
- not finishing tasks, undertaking new tasks constantly
- problems with mental concentration and attentiveness, forgetfulness
- disinclination to work

Long-term symptoms

A long-term stress exposure and its related chronic physiological irritation impose a heavy burden on digestive, cardiovascular and immune functions, therefore, it could be an important factor in the development of psychic and psychosomatic disturbances and diseases [7].

Experiencing even one or two of these symptoms can make you feel anxious or frustrated. This can be a vicious circle. For example, you want to avoid stress, but symptoms such as frequent crying or nervous twitching can make you feel annoyed with yourself and even more stressed.

If you have experienced some of these symptoms for a long time, you are at risk of developing high blood pressure (hypertension). This can lead to:

- a heart attack: a serious medical emergency where the supply of blood to your heart is suddenly blocked, usually by a blood clot
- a stroke: a serious medical condition that occurs when the blood supply to the brain is interrupted.

The results of [8] study shows that men and women are significantly different in some stress related measures. Women indicated significantly higher levels of occupational stress than men. Women also indicated significantly higher levels of psychological symptoms than men, but the two groups reported similar emotional and physical health. [9] found out that female managers experienced "emotional stress", primarily because of the pressure to meet expectations of being responsible and caring for people both inside and outside of their home. In contrast, male managers tended to focus on themselves and regard other things as beyond their control or responsibility.

[10] conducted 19 studies which indicated that women tend to report higher rates of psychological distress and that men are more prone to severe physical illness. It has been well recognized that individual differences in general perform an important moderating function on the impact of stress. Some models of stress identify gender as a critical personal or demographic characteristic that influences the nature of an individual's stress experience [10].

In the study presented we tried to establish the differences between the genders in terms of occupational stress level, as well as the frequency and intensity of stress symptoms appearance.

2. METHOD

2.1. Participants

Our sample includes 85 managers, i.e. 43 women and 42 men, of randomly selected Slovene companies.

2.2. Measures

For the purpose of our research we designed a questionnaire Occupational Stress Load of Managers. For the second and third question we used a Lykert scale ranking system (5-point scales).

The questionnaire is in three parts and includes:

1. Participants' socio-demografic data
2. Questions related to a subjective assessment of the stress level
3. List identifying stress symptoms - it includes the list of moods and states of health which are considered as the results of stress (cf. [3], [11], [12], [13]). Managers assessed them on a 5-point Lykert scale twice, i.e. in relation to:

- frequency of their appearance – on the scale from 'never' (1) to 'very frequently' (5)
- their annoyance – on the scale from completely disannoying (1) to most annoying (5)

2.3. Procedure

The obtained data was processed with SPSS computer programme and the following data processing statistic methods were used to analyze them:

- descriptive statistics and frequency distribution - for variables
- t-test – to examine the statistic relevance of the differences between the genders in terms of stress symptoms

All our statistically relevant conclusions were drawn at a 95% confidence interval.

3. RESULTS AND DISCUSSION

3.1. Descriptive statistics

Our research includes 85 managers from randomly selected Slovene companies. Among them, there were 43 women and 42 men.

The survey results demonstrate that the most numerous group in our sample is aged between 31 and 40 (49.4%), followed by the group aged between 41 and 50 (34.1%). The smallest percentage (16.5%) is the group aged less than 30.

In terms of qualification, the highest share (92.9%) in our sample goes to the group with higher level of education. Furthermore, in terms of years of service, 41.2% of managers involved in our research fall in the group with 11 to 20 years of service, 27.1% in the group with 6 to 10 years of service, and the others with more than 20 or less than 6 years of service. Table 1 shows the structural share of the respondents (managers) as to the number of employees in a given company.

3.2. Hypotheses and discussion

The hypotheses were tested by means of t-test, which was employed to examine the statistic relevance of the differences between the genders as well as the symptoms of work-related stress.

Hypothesis 1: There are differences between men and women in experiencing stress at workplace.

Table 1. *T-test results for assessing the existence of differences between men and women in experiencing stress (in terms of intensity level) at workplace*

Item	F	t	df	Sig. (2-tailed)	Mean difference
Stress level	1.944	-2.058	83	.043*	-.26523

N.B.: * for $p < .05$

By means of t-test for independent samples we established that there were gender differences in experiencing occupational stress, namely women experience a higher level of occupational stress than men.

In his research, [8] also established that women indicated significantly higher levels of occupational stress than men.

Hypothesis 2: There are differences between men and women in terms of stress symptoms frequency.

Table 2. *T-test results for assessing the existence of differences in terms of stress symptom frequency*

Item	F	t	df	Sig. (2-tailed)	Mean difference
Waking throughout the night	1.246	2.117	83	.037*	.54596
Anxiety	18.974	3.931	83	.000***	.68217
Depression	9.870	2.158	83	.034*	.42082
Hyper-sensitivity	.880	2.631	83	.010**	.45349
Desire to quit the job	14.955	2.098	83	.039*	.33001
Caffeine, Nicotine	7.322	2.218	83	.029*	.49945
Tranquill-izers	75.903	3.728	83	.000***	.44075

N.B.: * for $p < .05$; ** for $p < .01$; *** for $p < .001$

Table 2 shows statistically significant gender differences in various items in terms of stress symptom frequency. Hypothesis 2 can be partly accepted as there are gender differences only in those items or symptoms, respectively, which reflect the frequency of stress symptom appearance. In terms of stress symptom frequency there are gender differences in the following items or symptoms: waking throughout the night, anxiety, depression, hypersensitivity, the desire to quit the job, high use of caffeine and nicotine and frequent use of tranquillizers. Managerial women were found to wake through the night or in the early hours statistically significantly more frequently than their male counterparts, they more frequently experience anxiety and depression symptoms, are more frequently prone to hypersensitivity, have a greater desire to quit the job, they more frequently over-consume caffeine and nicotine, and use tranquillizers more frequently than men.

In his research [8] obtained similar results: he proved that managerial and professional women indicated significantly higher levels of psychological symptoms than men.

Hypothesis 3: There are gender differences in the intensity of experiencing stress symptoms.

Table 3. *T-test results for assessing the existence of differences in terms of the intensity of experiencing stress symptoms*

Symptom	F	t	df	Sig. (2-tailed)	Mean difference
Nervous tics	.136	-2.707	83	.008**	.54430
Waking throughout the night	14.001	2.268	83	.026*	.61849
Fatigue	.110	3.200	83	.002**	.77962
Moodiness	.140	2.561	83	.012*	.54983
Forgetfulness	4.364	2.565	83	.012*	.75692
Absentmindedness	1.591	2.516	83	.014*	.73145
Indecision	.617	2.448	83	.016*	.64286
Concentration problems	1.206	2.585	83	.011*	.66667
Feeling of failure	13.900	4.114	83	.000***	1.18217
Tranquilli-zers abuse	1.781	2.502	83	.014	.74252

N.B.: * for $p < .05$; ** for $p <$,01; *** for $p <$,001

Table 5 shows statistically significant differences in the intensity of experiencing stress symptoms. Hypothesis 3 can be partly accepted as there are gender differences in some items or symptoms which reflect the intensity of experiencing stress symptoms. Therefore, in terms of the intensity of experiencing stress, there are gender differences in the following items or symptoms: nervous tics, waking throughout the night or in the early hours, fatigue, lack of energy, moodiness, forgetfulness, absentmindedness, indecision, concentration problems, feeling of failure and frequent consumption of tranquillizers. Nervous tics (as stress symptoms) are most disturbing in men while all other symptoms mentioned above are experienced as more disturbing in women.

4. CONCLUSION

Occupational stress has been on the increase and has become a major problem of the working world. World Health Organizations monitors with great concern, the increase in problems related to occupational stress [14]. Occupational stress, with all its consequences, is widely spread among the EU member states. According to various studies, managers in the acceding EU member states are exposed to stress and are overloaded with work to a higher extent than their western counterparts. To make it short, stress in employees has a serious effect on a company's bottom line as numerous working days are lost due to stress consequences.

Employers are obliged to limit and suppress stress by striving to prevent stress in their organizations, assessing risks for stress appearance and through this process reveal the stress risks at workplace. Employers can also estimate and determine which position of employment or workplace is exposed to higher risks. Furthermore, employers are obliged to take the necessary measures (to prevent damage or avoid loss) to comply with the guidelines issued by the European Agency for Occupational Safety and Health.

Organizations in Slovenia will need to put a lot of effort into stress preventing activities at workplace, especially as many organizations are not being aware of the dimension of the problem and its negative consequences. Moreover, to be able to manage stress in their employees, organizations in Slovenia will have to apply numerous measures and they will also have to allocate the funds assigned to covering costs for the purpose of preventing occupational stress consequences. Finally, it is of utmost importance for an organization success and performance to involve all their employees in planning and executing company objectives.

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STRES I SIMPTOMI STRESA KOD MENADŽERA U SLOVENIJI

Maja Meško, Jera Zajec, Zlatka Meško Štok, Mirko Markič

Apstrakt: *Cilj rada je identifikacija nivoa stresa na poslu, učestalost simptoma stresa među slovenačkim menadžerima i definisanje razlika u polovima u smislu doživljavanja intenziteta simptoma stresa. U ovoj studiji je učestvovalo 85 menadžera srednjeg nivoa iz slovenačkih kompanija, po metodi slučajnog izbora. Dobijeni podaci su obrađeni u programu SPSS 16.0, kao i pomoću metoda deskriptivne statistike, raspodele frekvencija i t-testa za obradu statističkih podataka. Rezultati ove studije su pokazali da postoje razlike u pogledu gore pomenutih faktora kod žena i muškaraca, odnosno da postoji statistički veći nivo stresa kod žena. U pogledu nastanka simptoma stresa, postoje razlike između polova u pojedinim simptomima stresa, kao i razlike u intenzitetu simptoma stresa.*

Ključne reči: radno mesto, menadžeri, srednji nivo menadžmenta, preduzeća u Sloveniji, stres, simptomi stresa, razlike između polova.

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HAZARDS RELATED TO COLLECTION, TRANSPORTATION AND DISPOSAL OF URBAN WASTES IN TIRANA MUNICIPALITY

Abstract: *The purpose of this study is to investigate the environmental issues that accompany the entire process of waste collection, transportation and disposal in Tirana Municipality. Municipal (urban) waste management has emerged as one of the greatest challenges facing environmental institutions in Tirana and elsewhere in Albania. Urban waste management is characterized by inefficient collection methods, insufficient coverage of the collection system and improper disposal of wastes and a poor environmental awareness on the part of residents. The study also provides a detailed examination of municipal wastes (organic and inorganic ones), solid wastes in the form of demolition materials hauled from construction firms, household items etc. The study does a risk analysis of the damage to environment in the way of quantification of wastes that is based on the source of collection-transportation-target disposal point and brings to light issues that are of environmental concern.*

Key words: waste collection, processing, waste disposal, urban waste management

INTRODUCTION

Tirana is the capital city of Albania with a population within city limits estimated at 421,286. Tirana and the immediate surrounding areas have a combined population of 763,634. Many communes and villages have merged with the city due to urban sprawl and unplanned urban development, so they can be viewed as constituent parts of Tirana. The city is mostly surrounded by hills with Dajti Mountain on the east and the presence of an artificial lake that is extensively being utilized as a recreational area for the Tirana residents. The Municipality of Tirana is divided into 11 smaller administrative units referred to as Municipal Units.

Figure 1. *Map of Tirana city*

The Government of Albania has passed various laws and regulations that are intended to safeguard the environment. One such law is urban waste law [9], whose scope is '*to protect the environment and health from pollution and damage from solid wastes during the entire process of collection, sorting, transportation, recycling, processing and disposal"*. The law further suggests that '*harmful wastes should be properly disposed and their presence be reduced to the largest extent possible'*. Pursuant to the law [9] each local government in the country has set up its own environmental protection body for the protection and improvement of the environment within its jurisdiction. One problem of huge concern is the collection and processing of municipal waste generated by the city residents. Municipal waste is defined to '*include refuse from households, non-hazardous solid waste from industrial, commercial and institutional establishments (including hospitals), market waste, yard waste, and street sweepings"*.

The rapid changes in Albania as well as in the rest of other developing countries concentrated huge numbers of people in urban areas of very high population density and added new sources of wastes from shops, institutions and small-sized factories which were set up to employ the immediate population. Under such conditions, it is almost impossible to handle and accommodate these wastes, arising at a rate of up to one ton/family/year within the urban areas [2]. Most of the time waste generated ends up not being collected but dumped in many areas. One to two thirds of the solid waste generation in developing countries is not collected [4]. It is understandable that the disposal and transportation of solid waste in Tirana has added to major waste management problems.

According to the data obtained from the Regional Environmental Office the cities which pose the greatest environmental risks are Tirana, Durres, Fieri, Vlora, and Elbasani [6]. These cities are also the most densely populated cities with huge population concentrations that were mainly the result of inner migration movements and shifts. According to various studies, Tirana city produces the most wastes of all cities. The total amount of waste generated is roughly 22.700 tons

per day. The total amount of wastes generated at the country level is some 40 000 tons [8]. Wastes volumes in these cities are not constant throughout the year, there is variation based on various factors. Waste characteristics vary according to season, income level, population, social behaviour, climate, and industrial production, the size of markets for waste materials and the extent of urbanization, effectiveness of recycling, and work reduction [2]. There is little or no recycling at the country level. By contrast, in UK household waste alone accounts for only 9% of total waste, a high proportion is land-filled and recycling rates are low [1, 7]. Recycling is a method of solid waste management like controlling or incineration, but is environmentally more desirable [3].

Tirana city does suffer from problems related to overpopulation that in turn has triggered extensive waste generation, high levels of air and water pollution. Air pollution has worsened in the past two decades because of problems related to the number of old cars used in the city. Another source of pollution is inhaled particulate matters and NO2 gases, resulting mainly from rapid growth in the construction of new buildings and expanding road infrastructure [8].

MATERIALS AND STUDY

For purposes of the current study an investigation in the field in Tirana city was conducted to analyse the entire process that started with the disposal of households in the garbage bins as the first collection point at the quarter level, the transportation of garbage to the wastes dump and the wastes handling at the dumping site (now a landfill). The focus of the study was the analysis of make-up/composition of the garbage generated by the households, the nature of wastes at the garbage bins and the methods of collection. Trips were frequent to the dumping site to observe the processes of sorting garbage along with the process of handling them. The analysis also involved examining the contents of random garbage bins by way of their physical and chemical properties with a quantification of such wastes occurring randomly. Also the residents, scavengers, private contractors were interviewed to confirm the collection, disposal and treatment procedures, recycling practice and problems facing solid waste management.

Results and discussion of the study

Pollution deriving from *at-the-source collection of urban wastes* in the bins poses health hazards to the population in the various quarters of Tirana city. In most cases, such wastes are carried in shopping plastic bags (not the garbage bags) which burst open and spill out into the streets which become a source of pollution to residents in apartment buildings located in the vicinity of designated places where garbage bins are located. The pollutants present in such places are mainly of a solid, liquid and gaseous nature. The garbage bins in turn are located in areas designated by the mini municipality units of Tirana city. They are located in areas very close to the apartment buildings, at times remotely located and not well-placed because households find them as inconvenient and throw wastes almost anywhere invading public spaces. There is 2-3 garbage bins for each waste collection point which are used for wastes disposal by a total of 100 households in any given area.

Often one thinks of the garbage bins at the source as containing mainly domestic refuse of mixed materials, i.e. glass, metal, kitchen wastes, ashes from fires, broken utensils, papers and worn-out clothing. Yet, a common sight in the garbage bins is the disposal of worn-out furniture which urges the second-hand collectors (scavengers) to rummage through the contents of the bins scattering refuse around the spot where such bins are located. Environmental awareness of such residents needs to be raised further because such activities harm not only those handling such wastes, but also the population in the vicinity.

In addition, municipal wastes are rich in organic matter and consist of various ingredients such as animal residues, dairy or slaughterhouse wastes. These may seem to be eco-friendly to some extent but overpowering odours and health hazards are inherent in them. The following table presents the type of wastes and the source they come from in a given designated bin spot in Tirana.

Table 1. *Charcterization of household wastes at the point of collection*

Type of wastes	Characterization of wastes	Source of wastes
Food wastes	Garbage (prone to decompose)	Originate from food products of animal and vegetable origin, arising out of preparation, processing, handling, catering, and eating.
Rubbish	Combustible Non-combustible	Paper, cardboard, worn-out furniture textiles, plastics, rubber, etc glass, ceramics, metals, etc.
Construction/Demolition materials	Construction materials Demolition of materials	broken pieces of bricks, stones, plasters, dirt, sand, wooden articles, metal pieces, electrical parts, etc.
Others	Organic wastes	slaughtered parts from the various butcher's shops etc.dairy wastes etc

The following graph is indicative of the percentage of wastes generated on a single day at any given designated dumping place where bins are provided for.

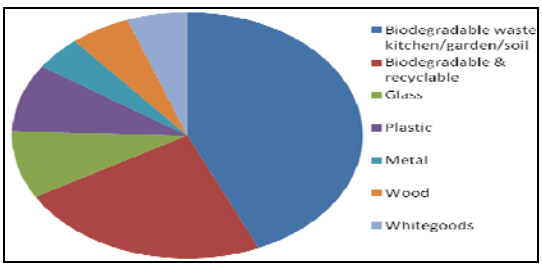

Figure 2. *Percentage of composition of municipal wastes*

The total number of particles in the wastes examined varies largely. A sample of large wastes shows average moisture content of 10-15 % and the moisture content tends to increase with increase in food wastes. Components like food wastes, garden wastes and others contribute to the higher densities of the main mass of wastes, ranging from 130 to 1500 kg/m3, a typical waste sample exhibits average density of 1200 kg/m3. There is also an increase in dry and inert components, i.e., ashes and cinders, which decreases the average density. This has great significance for the transport and storage aspect of the municipal wastes.

With changing patterns of living style and human cultural activities, waste composition is also changing over the years. It is noteworthy that plastic and paper components have increased and likely to maintain this pattern throughout, whereas, glass is likely to decline in the coming years. The content of glass and plastic in the bins has increased the activity of those collecting such items at the source for recycling purposes. Yet the recycling of plastic is considered to be a problem because most of them end up being re-used again, where most plastic may be traced to dangerous materials used previously. At the moment there is a piece of legislation passed which is intended to curb the use of recycled plastic, mainly for plastic bags, since they are deemed to be hazardous to human health.

WASTES COLLECTION PRACTICES

Tirana municipality has outsourced a private contractual waste collection company that deals in collecting municipal waste. There is no categorized municipal collection say organic, glass, metal, textile etc., as is the case in other advanced countries. In some countries, notably Estonia and Hungary, the introduction of separate collection schemes for biodegradable packaging waste (paper, cardboard and wood packaging) pursuant to the Packaging Directive [5]) has helped initiate the diversion of biodegradable waste from landfill. In Albania the collection practice is hugely influenced by climatic variations that at times trigger the spreading of foul odours that are a nuisance to the residents within the designated dumping places. At times, they become the focal point of stray dogs that become menacing to the passers-by who have to use the sidewalks to get to their destinations. Most of these dogs are not vaccinated and there have been high incidences of pedestrians seeking immediate medical help because of the dog bites. At times the holding tanks result in undesirable spill-over or strewing of portion of household wastes on the streets. During hot weather the bins become infested with swarm of flies and other insects which become a source of spreading various diseases.

At times the designation of bins (dumping places) is not well planned to accommodate the huge volume of wastes generated by the enormous number of population in a specific area. There are areas within a certain quarter which are densely congested with residential buildings. The total number of capita per unit of bin is quite high in areas where multi-story buildings are present. So the generation of refuse is pretty huge in such areas. There is a need for collection policies to change in such areas with a need for an increase in the frequency of garbage pick-up during the 24 hour pick-up schedule.

Problems with Sharra landfill in the vicinity of Tirana

Some efforts have been luanched to rehabilitate the Sharra garbage dumping spot because it was considered to be the most dangerous spot of wastes disposal in Tirana. Due to some interventions in the dumps the beginning of a landfill were in the making but the location of the landfill in the vicinity of Tirana falls short of meeting standards of eleborate and expensive landfills which require a detailed planning, a feasibility study and the consideration of many environmental and health issues.

Problems with this landfill relate to the *location*, which is very close to the Kombinat quarter in the outskirts of Tirana, a densely-populated part of the city which has swelled beyond its holding capacity particularly after the 1990s. It also poses health risks to a number of residents, who due to poor and inadequate urban planning have settled around the landfill. The gases released from the landfill are of huge consequences to the health of residents which has resulted in a high incidence of related-lung diseases. A persistent burning of wastes release gases that are poisonoues in nature and harmful to humans. Pollutants released from burning waste are transported through the air either short or long distances, and are then deposited onto land or into bodies of water. The most prevalent of such harmful pollutants include carbon monoxide, carbon dioxide, and nitrogen oxides which are emitted from burning household waste. Chemicals commonly detected in the smoke include benzene, styrene, formaldehyde, polychlorin-ated dibenzodioxins (PCDDs; also known as dioxins), polychlorinated biphenyls (PCBs), polychlorinated dibenzofurans etc. Another problem that is of serious consequences to the health of citizens relates to the overwhelming odors that can be felt in the surrounding areas.

CONCLUSIONS

There is a need to improve the municipal waste management plans in Tirana city. There is room for improvement concerning the adoption of legislation that reflects the European directives on waste disposal and landfill infrastructure. In addition, the city should initiate separate collection of bio-waste to divert waste from landfill. There is e need to start sorting wastes right at the initial stage of waste collection. The city should start utilizing wastes for production of energy and not incinerate wastes at the dumping place since damage to environment is irreparable. The landfill is not capable of handling all of the wastes generated by the city. Hence the need for another landfill in a place

that should be well studied and examined by taking note of the best standards in landfill construction as European directives require. The study suggests the need for a more extensive study of institutional, political, social, financial, economic and technical aspects of municipal solid waste management in order to achieve sustainable and effective solid waste management in Tirana city.

ACKNOWLEDGMENTS

The waste study of the Municipality of Tirana and the surrounding areas referred to in this paper was part of a joint effort of the three authors, under a previous project, who have long shown an interest in solving waste issues according to the best practices implemented in other European countries. Yet, there is a need to finance studies of the sort in other hot-spots in Albania in order to address issues that arise with waste disposal and landfill management.

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OPASNOSTI VEZANE ZA PRIKUPLJANJE, PREVOZ I ODLAGANJE URBANOG OTPADA U OPŠTINI TIRANA

Arjan Shumeli, Albert Kopali, Etleva Jojiç

Apstrakt: *Cilj rada je istraživanje problema životne sredine koji obuhvata kompletan proces sakupljanja, transporta i odlaganja otpada u opštini Tirana. Upravljanje komunalnim otpadom je jedan od najvećih izazova sa kojima se susreću institucije koje se bave zaštitom životne sredine u Tirani i drugim mestima u Albaniji. Upravljanje komunalnim otpadom karakterišu neefikasne metode prikupljanja, nedovoljna pokrivenost sistema prikupljanja i nepropisno odlaganje otpada. U radu je takođe dat detaljan pregled komunalnog otpada (organski i neorganski otpad); čvrst otpad koji čini otpadni građevinski material iz građevinskih firmi, otpad iz domaćinstva, itd. Ova studija prikazuje analizu rizika ekološke štete kroz kvantifikaciju otpada koji se nalazi na tački gde se vrši prikupljanje, transport i odlaganje otpada, baveći se pitanjima koja su od ekološkog značaja. Cilj ovog istraživanja je pružanje pomoći departmanima u upravi za upravljanjanje otpadom u opštini Tirana, kao i donosiocima odluka na centralnom i lokalnom nivou i različitim stejkholderima u implementaciji odgovarajućih metodologija za prikupljanje i odlaganje komunalnog otpada.*

Ključne reči: sakupljanje, prerada, odlaganje otpada, upravljanje komunalnim otpadom.

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OVERVIEW ON THE REFERENCE LEVELS FOR LOW FREQUENCY ELECTRIC AND MAGNETIC FIELDS IN THE LEGISLATION OF SOUTHEAST EUROPEAN COUNTRIES

Abstract: *In order to prevent adverse health effects from exposure to low frequency electric and magnetic fields, numerous national and international regulations have been published. They regulate the basic threshold and reference levels of exposure, exposure durations, measurement procedures and precautionary measures in case of exceeding the prescribed values. While many countries have implemented these regulations, in some countries they are only partially implemented or there is the absence of such regulations into their national legislation.*

This paper gives an overview of the applied regulations in the countries of Southeast Europe, concerning public and occupational safety from low frequency electric and magnetic fields. The aim of the paper is to determine the level of implementation of these regulations in the region.

Key words: low frequency, electric field, magnetic field, occupational exposure, public exposure.

INTRODUCTION

The health effects of exposure to low frequency electric and magnetic fields have been investigated over a long period. With the current research database covering several thousand studies, the direct correlation between the low frequency electric and magnetic fields and long term adverse health effects have still not been confirmed. Among the most notable results of these studies are: determination of weak statistical association of the childhood leukaemia with the long term exposure to intense low frequency magnetic fields [1] and proven short-term biological reactions as reduced perception, anxiety, nerves and muscle stimulations.

Based on the currently available knowledge, in 1998, the International Commission on Non-Ionizing Radiation Protection (ICNIRP) published "Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields" [2]. The reference levels provided by ICNIRP for low frequencies have been defined to prevent short-term, immediate effects such as nerves and muscle stimulation, associated with exposure to intense electric and magnetic fields. In 2010, ICNIRP made revision of the guidelines from 1998 [2] and published new guidelines for low frequencies (1Hz – 100 kHz) [3], which have not yet led to changes in the EU legislation. In this document, it is stated that the results of the epidemiological studies do not justify further decrease of the reference levels, since they do not indicate direct correlation of the low frequency electric and magnetic fields with specific health problems. However, considering the weak correlation of the low frequency magnetic fields and the childhood leukaemia, the International Agency for Research on Cancer classifies these magnetic fields as "possibly carcinogenic " to humans, group 2B [1].

In order to prevent adverse health effects from the exposure to low frequency electric and magnetic fields, many countries implement national and international regulations as binding into their legislation or use them in the form of advice that indicate the health risks.

The majority of European countries follow the recommendation of European Council (1999/519/EC) [4] and use the standards and limits based on the guidelines provided by [2]. Many countries implement stricter limits than those provided by ICNIRP. These limits depend on the frequency, vicinity of the sources and the target groups (sensitive groups, general public or professionals) [5]. However, some countries only partially implement these regulations or there is the absence of such regulations in their legislation.

The following text gives an overview of the applied regulations in the Southeast European countries, in order to determine the level of their implementation in the region.

REGULATIONS IN THE REGION

Serbia

The "Law on non-ionizing radiation protection" (Official Gazette of RS No. 36/09) regulates the conditions and measures for environmental and human health protection from the adverse effect of the non-ionizing radiation while using sources of non-ionizing radiation [6]. On the basis of the article 6, paragraph 6 of this law, the "Rulebook on the limits of exposure to

non-ionizing radiation" (Official Gazette of RS No.104/09) [7] was issued. This rulebook prescribes the basic restrictions and reference levels for public exposure to electromagnetic fields. The reference levels provided by this rulebook are given in Table 1.

Table 1. *Reference levels for public exposure on low frequency electric and magnetic fields in Serbia*

Frequency	Electric field strength E [V/m]	Magnetic flux density B [uT]
< 1 Hz	5600	16 000
1-8 Hz	4000	16 000/f^2
8-25 Hz	4000	2 000/f
0,025-0,8 kHz	100/f	2/f
0,8-3 kHz	100/f	2,5
3-100 kHz	34,8	2,5

The comparison of the reference levels in Serbia, provided in [7] and those provided by ICNIRP [2],[3] for public exposure, is illustrated in Fig. 1.

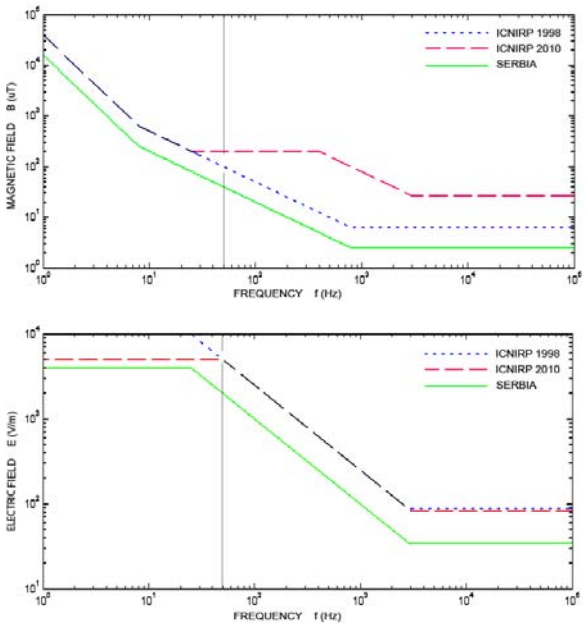

Figure 1. *Serbian vs. ICNIRP reference levels for public exposure on low frequency electric and magnetic fields*

The Serbian regulations are stricter, and allow only 40% of the reference levels provided by ICNIRP [2]. However, these regulations are only applicable for general public exposure of non-ionizing radiation.

Croatia

On 9 July, 2010, the Croatian parliament adopted the "Law for non-ionizing radiation" (Official Gazette of Croatia No.91/10) [8]. On the basis of article 8 paragraph 2 of this law, the Ministry of Health issued the "Rulebook on Protection from Electromagnetic Fields" (Official Gazette of Croatia No.98/11) [9]. This rulebook prescribes the basic threshold and reference levels on public and occupational exposure to electromagnetic fields from 1 Hz to 300 GHz. The reference levels for public exposure are the same as in Serbia (provided in Table 1), and the reference levels for occupational exposure are provided in Table 2.

Table 2. *Reference levels for occupational exposure on low frequency electric and magnetic fields in Croatia*

Frequency	Electric field strength E [V/m]	Magnetic flux density B [uT]
< 1 Hz	14 000	40 000
1-8 Hz	10 000	40 000/f^2
8-25 Hz	10 000	5 000/f
0,025-0,8 kHz	250/f	5/f
0,8-3 kHz	250/f	6,25
3-100 kHz	87	6,25

The comparison of the reference levels in Croatia, provided in [9] and those provided by ICNIRP [2],[3] for occupational exposure, is illustrated in Fig. 2.

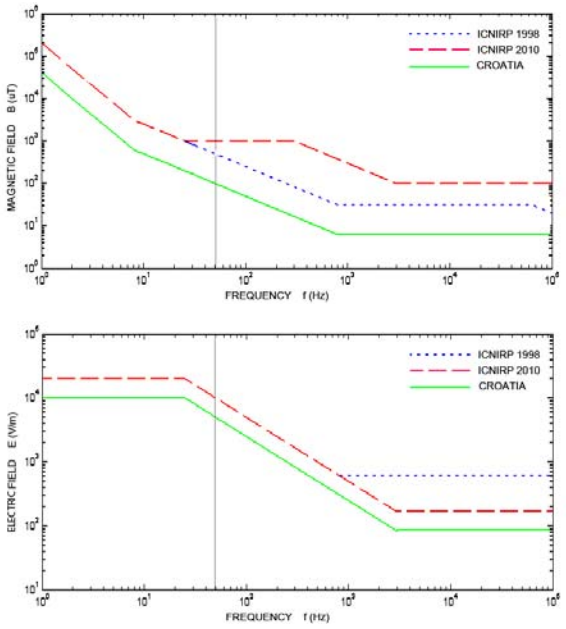

Figure 2. *Croatian vs. ICNIRP reference levels for occupational exposure on LF electric and magnetic fields*

The reference levels in Croatia for general public and occupational exposure to low frequency electric and magnetic fields are stricter than the reference levels provided in [2] and [3].

Greece

In 2002, Greece implemented measures for protection of the general public from low frequency electric and magnetic fields exposure, by putting into force the legislative act "Protection measures for the exposure of the general public to all low frequency electric and magnetic fields emitting devices" (GG No.512, Vol. B 25-4-2002) [10]. This legislative act implements the basic restrictions and reference levels recommended by the Council of the European Union for frequencies from 0 Hz to 300 GHz (1999/519/EC) [4].

For the low frequency electric and magnetic fields, the

reference levels provided in the ICNIRP guidelines [2] are applied. For the EMF from antenna systems, the limits are set to 80% and 60% from the limits given in the ICNIRP guidelines [2] if the antennas are located less than 300m from schools, kinder gardens or hospitals.
However, there is no national legislation with binding limits for professional exposure to low frequency and radiofrequency EMF in Greece.

Bulgaria

In the Bulgarian legislation, national standards for non-ionizing radiation have been implemented. They define limiting levels for: occupational exposure to electric and magnetic fields at low frequencies (Ordinance No. 7, Gov. News No. 88/1999) [11] and public and occupational exposure in the radio frequency and microwave range (Ordinance No. 9, Gov. News No.35/1991) [12]. The reference levels for occupational exposure to low frequencies are provided in Table 3.

Table 3 *Reference levels for occupational exposure on low frequency electric and magnetic fields in Bulgaria*

Frequency	Electric field strength E [V/m]	Magnetic flux density B [mT]
0 - 100 Hz	25 000	60/f *
100 Hz - 4 kHz	$2.5 \cdot 10^6$ /f	60/f
4 - 60 kHz	625	60/f

* Maximum 60T for static magnetic fields

The comparison illustrated in Fig. 3 indicates that the reference levels for occupational exposure to electric fields, provided by [11], are more lenient than those provided by ICNIRP [2] and [3], while the reference levels for magnetic fields are stricter or more lenient depending on the frequency.

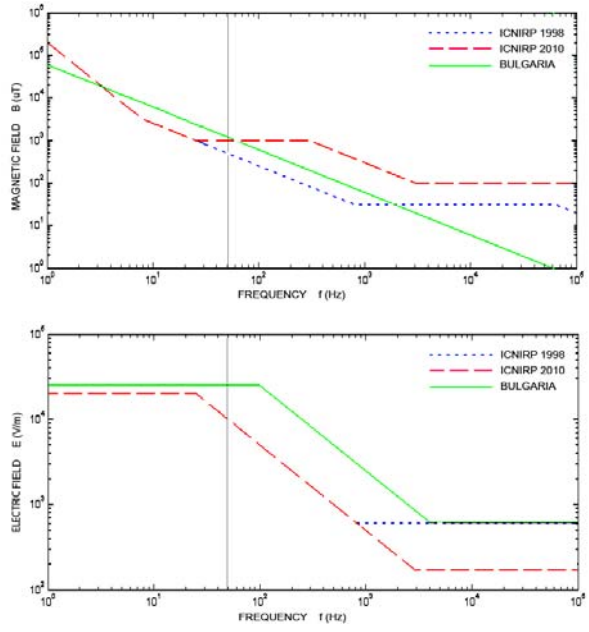

Figure 3. *Bulgarian vs. ICNIRP reference levels for occupational exposure on LF electric and magnetic fields*

The maximum duration of occupational exposure to intense electric fields in the vicinity of high-voltage equipment at power frequency (50 Hz) is defined in the Bulgarian national standard BNS 12.1.002-78 [13]. The exposure durations defined by this standard are provided in Table 4.

Table 4. *Maximum duration of occupational exposure on intense electric fields, defined by BNS 12.1.002-7*

Electric field strength E [kV/m]	Permissible duration of exposure t [minutes/day]
< 5	No limit
5 - 10	< 180
10 - 15	< 90
15 - 20	< 10
20 - 25	< 5
> 25	Access only with equipment for personal or collective protection

The Bulgarian legislation has not implemented limiting values for general public exposure to low frequency electric and magnetic fields.

Macedonia

In Macedonia there is no legislation that regulates the reference levels for public and occupational exposure to electric and magnetic fields at low frequencies. The "Rulebook for maximum permissible levels of human exposure on non-ionizing radiation" (Official Gazette of SFRY No. 50/90) is applicable for public and occupational exposure at frequencies from 300 kHz to 300 GHz. Therefore the European regulations for low frequencies are implemented as non-binding. The law for non-ionizing radiation has been in preparation for several years, and it has not been stated when it will be implemented.

CONCLUSION

In this paper, the authors have provided an overview of the level of implementation of the regulations concerning public and occupational exposure to low frequency electric and magnetic fields in the Southeast European countries. The above data indicate that in these countries, some regulations have been partially implemented or completely absent from their national legislation. The same trend has been observed in other countries worldwide.

Although measurements indicate that the electric and magnetic fields near power equipment are usually compliant with the reference levels, in some cases they can exceed these limits. The absence of legislation that should establish the limits and standards for protection from non-ionizing radiation is yet another obstacle in providing legal protection of the people whose safety is potentially compromised.

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PREGLED REFERENTNIH NIVOA ZA NISKOFREKVENTNA ELEKTRIČNA I MAGNETNA POLJA U DRŽAVAMA JUGOISTOČNE EVROPE

Blagoja Markovski, Leonid Grčev, Marija Kacarska

Apstrakt: *U cilju sprečavanja negativnih efekata po zdravlje ljudi od izloženosti niskofrekventnim električnim i magnetnim poljima, objavljeni su brojni nacionalni i međunarodni propisi. Oni regulišu: osnovne granične i referetne nivoe izloženosti, vreme trajanja izloženosti, merne procedure i mere predostrožnosti u slučaju prekoračenja propisanih vrednosti. Dok se u mnogim zemljama ovi propisi već primenjuju, u pojedinim zemljama su samo delimično implementirani ili uopšte ne postoje takvi propisi u njihovom nacionalnom zakonodavstvu.*

Ovaj rad daje pregled primenjenih propisa u zemljama jugoistočne Evrope koji se odnose na javne i profesinalne mere zaštite od izlaganja niskofrekventnim električnim i magnetnim poljima. Cilj ovog rada je utvrđivanje stepena sprovođenja tih propisa u regionu.

Ključne reči: niske učestanosti, električno polje, magnetno polje, profesionalna izloženost, izloženost stanovništva.

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OCCUPATIONAL DISEASES INDUCED BY VIBRATIONS

Abstract: *Vibration is physical noxiousness which is present in different branches of industry. Vibration disease is the disease caused by professional vibrations. The disorders caused by acute and chronic, local or general exposure are numerous and very nonspecific. Vibration disease signs are expressed late during natural course of disease, and diagnosis is made with significant delay. The occupational disorders caused by vibration represents important segment in occupational medicine and occupational protection. Pathogenetic factors are microtrauma, spasm of arterial blood vessels and ischemia. The vibration damages all tissues but the cardiovascular, muscular, nervous system and bones are specially damaged. High frequent vibration damages cardiovascular system and low frequent vibration damages bones. Vibrations may represent contributing factor in development of occupational accidents. In the estimation of working ability the demands of workplaces, noxiousness, health state, functional state, motivation, length of working must be examined. The preventive steps include technical, organisational, and medical procedures as well as using of personal protective means. The vibrational disease has great impact on workers' health and demand further research and permanent labor regulation adjustment in this field.*

Key words: Occupational disease, Vibrations, Health, Hazard

INTRODUCTION

Occupational use of vibrating tools and exposure to vibration results in vibration disease. The patient is not only afflicted with peripheral disorders, but also with a systemic disorders and manifested laboratory and clinical finding [1]. The pathophysiology of vibration induced disorders is not fully clarified and proposed models are not fully evaluated [2]. Vibrational disease still represents medical issue without effective treatment [3].

The main problem in preventive approach to vibration disease is its slow and long progression. Many workers do not think that their exposure to vibration could be a health hazard because they do not have clinical manifestation in early phases of disease. Moreover, in the later stages, vibration disease could be presented with many non-specific symptoms that workers do not connect with the disease. As disease progress workers can suffer from serious health problems such as vascular and neurological disorders, spinal syndrome and back pain, carpal tunnel syndrome and other clinical manifestation [4, 5].

The exposure to vibration could be by whole-body and by hand an arm. These two types of vibration have different sources, affect different areas of the body, and produce different symptoms. Hand-transmitted vibration is limited to the hands and arms and is usually the consequence of the use of power hand tools. In this case vibration enters the body through the hands, e.g. in various work processes where rotating or percussive power tools are held by the workers' hands [6]. Whole-body vibration occurs when mechanical vibration enters by seat or feet, or both, often through driving or riding in motor vehicles and when working near some industrial machinery with frequencies of concern ranging from 0.5 to 80 Hz [7].

Male workers are mainly exposed, especially hand-tool workers, operators of a variety of vehicle categories such as cars, buses, forklifts, tractors, trucks, and heavy machinery, drivers of mobile machines, locomotives or people working in the vicinity of stationary machines. [8]. There is great variation in proportion of workers occupationally exposed to vibrations. This proportion varies widely between countries, from 14-34%, and is concentrated in the sectors of construction (63%), manufacture and mining (44%) and fishing (38 %) [9].

A great number of workers in different occupations exceeded limits to whole-body vibration (WBV) established by the European directive. This is more often observed in operators of most off-road machinery and heavy machines in agricultural forestry industry. In the case of fork-lift trucks, the action level is likely to be exceeded if they are driven for longer than three to four hours and in the case of trucks and lorries if they are driven all day long. However, the limit value is likely to be reached only rarely, except in the case of scrapers and some finishers [10]. The greatest concern involving WBV exposure is low back pain [4].

Regarding hand-arm vibration (HAV), the action level is likely to be exceeded by operators of most main

percussive and roto-percussive tools (such as chipping hammer, demolition hammer, rock drill, breaker, impact drill, scabbler, rammer, vibratory rammer), of main rotative tools (e.g. grinder, impact wrench, sander) and main alternative tools (e.g. jig-saw, file). The limit value for exposure to vibration may be exceeded if percussive and roto-percussive tools are used for more than one to two hours a day, or in the case of some rotative tools if used for more than four hours [9, 10].

Many novel tools and technological innovation are used in modern industry, mining, forestry and other branches of industry. This comprises different hand, pneumatic, electric and vibrating tools and devices. Although their manufacturing satisfied many rigorous standards for environment and health protection there are still hazardous effects on human health, especially by vibration induced disturbances [11]. Working with these devices is commonly associated with broader spectrum of symptoms and signs of vibration disorders. This leads to development of vibration disease. The intention is replacement of old pneumatic devices with devices engined by electric power aimed to reduce vibration but health issues still remain under question [10].

PHYSICAL CHARACTERISTICS OF VIBRATIONS

Vibrations imply any oscillatory motion of solid particles or bodies where material points periodically pass through the equilibrium position. This motion is continuous or steady periodic movement that can be simple, harmonic and very complex.

Apart from specific sources of oscillations, vibrations can be caused by noise of certain frequencies as well. Audio-frequency vibrations between 18 Hz and 20 000 Hz may cause noise. This type of noise shares the same physical characteristics of the noise arising from other sources. The only difference is that due to the possibility of propagation of vibrations through constructions noise can be transferred to other facilities as well.

The direction of the spread of vibrations can be vertical (in mechanical pneumatic hammers) and horizontal (in some types of hammer with horizontal beats). However, some advanced machines may have both directions including any direction between horizontal and vertical one. In practice, machine vibrations are mostly vertical while in pneumatic piston tools (air guns, hammers) they are parallel to the axis of the tool [12].

Vibrations cover a wide field of oscillations starting from the lowest values of Hz (Hertz) up to 20,000 Hz and over. The frequency area of few up to few thousands Hz. is in the focus of medicine. Frequency intensity ranging from 25 Hz and 8192 Hz is referred to as vibration velocity. It is in this range of orbital speed that a human body is most sensitive and this aspect of vibration velocity is especially important for consideration and research.

Occupational groups exposed mostly to local vibrations.

This group includes workers who work with vibrating hand tools such as diggers, miners, moulders, power cutters, forestry workers, workers in the footwear industry, workers in construction and road construction. Tools that generate these vibrations are pneumatic and electric drills, rotary hammers, grinders, chain saws, air guns, hammers, rams and the like [12].

Occupational groups exposed mostly to general vibrations

This group includes workers who work with transport services: drivers, conductors, drivers of agricultural machinery (tractor, combiners), workers in construction machinery (bulldozers, excavators, tippers), textile, tobacco and timber industry [9,13]. The most important finding for these mainly seating occupations is that the transmission of vibration through a seat depends on the impedance of the seat and the apparent mass of the seat occupant [14].

THE EFFECT OF VIBRATIONS ON THE ORGANISM OF EXPOSED WORKERS

The human body receives vibration via skin receptors, and proprioreceptors and interoreceptors of otolithic apparatus. Received vibrations spread all over the body of workers and can damage all their organs and systems. All tissues and organs are good transmitters of vibrations throughout the body. The most effective vibration dampers are joint cavities. The effects of vibration may result in irritation of central nervous system and vegetative nervous system thus having detrimental effect on cardiovascular, musculoskeletal, auditory-vestibular, and endocrine system as well [15].

Vascular disorders

Vascular disorders are detected primarily in the capillary and precapillary circulation and are present in high frequency vibration effects and in sudden shock effects which cause microtrauma of the nervous apparatus in skin. Tendency of capillary towards spasm is registered. Due to capillary spasm and small blood vessels subjective symptoms occur including paresthesia, attacks of white fingers, livid skin, cold hands. At first these spasms are functional and transient but gradually over time due to chronic effects of vibration some serious disorders may occur such as: hypertrophy of muscle walls of blood vessels, fibrous changes and constriction of lumen of blood vessels with signs of atherosclerotic changes in arterial blood vessels. Reduction of venous tone is observed in vibration disease. Veins are dilated which leads to slow venous circulation and venous routes. Venous pressure increases which leads to acrocianosis, local oedema of hands and difficulty of hand mobility [16].

Disorders of periphery and central nervous system

Disorders of peripheral nerves are prominent, manifested as the form of polyneuritis syndrome, followed by a variety of sensitive, trophic and vascular disorders [17].

Sensibility disorders

High frequency vibrations lead to damage of vibration sensibility, sensitivity to pain and sensitivity to thermal stimuli and touch. Reduced sensitivity to pain (hypoesthesia) on hands is determined by the type of gloves and reduced sensitivity to pain on feet is determined by the type of socks. The more advanced stages of disease are marked by disturbance of sensibility of segmental type usually involving innervation's area C4 - L5 or lower determined by the type of short coat-jacket (pseudosiringomieloid form) [18].

Biochemical changes in body of exposed workers

The effect of vibrations leads to disorder of metabolism of carbohydrates, fats, proteins, minerals and vitamins. Disturbance in terms of reduction of serum concentrations of vitamin C, B1, B2 and B6 caused by the effects of vibration has been observed.

Reduction of serum concentrations of albumin and globulin increase with the decrease in albumin globulin coefficient in workers exposed to vibration has been determined. Workers exposed to vibration are more prone to develop hypophosphataemia and hypocalcemia with decreased calcium phosphorus ratio [19].

Muscular changes

The following changes occur in muscular system [13, 19]:

- presence of painful infiltrative changes such as myofascikulitis and cellulitis on muscles of the upper arms,
- tendovaginitis of m. biceps brachi and hand extensors,
- contractures of Dupuytren type,
- disorders of muscle metabolism with destruction of muscular fibres and their nuclei as well as reduction in RNA content in cytoplasm of muscular fibres and DNA in nuclei,
- disorders of structure of motor planes with disorder of localisation of cholinesterase in cross striated muscles.

Skeletal changes

Vibration, counter strikes and static wrist strain of joints and bones lead to following disorders:

- radiological examinations of the shoulder joint reveals spur-like deformed osteoarthrosis.
- clinical picture shows limited and painful mobility of shoulder joint.

Due to proliferation of periosteum and deposition of calcium salts on the attachment points of periosteum and joint capsule on elbow joints pinnacles are formed and osteoarthrosis is observed radiologically manifested as elbow spur or a parrot's beak (ossified attachments of m. triceps with olekranon). Due to pathological fractures free joint bodies (joint mice) are created making joint movements limited and very painful [20].

The wrist joint may be affected by vibrogenic cysts, osteoporosis, enostosis, egzostosis, vibrogenic fractures and aseptic vibrogenic necrosis as a result of compromised circulation and nutrition of bone tissue.

The spinal cord may be affected by osteoporosis of vertebral body, spondylosis, osteochondrosis, stem growths, deformation of vertebral bodies and intravertebral disc hernia (Schmorl hernia) [21].

Disorders of other organs functions

- Disorders of cardiovascular system are present in the form of tachycardia, rhythm disturbances, and increased arterial blood pressure.
- Gastrointestinal system dysfunction is reflected in terms of hypersecretion or hiposecretion, intestinal dyskinesia, peptic ulcer and duodenal ulcer.
- Disruption of coronary and cerebral circulation is manifested as coronary heart disease or stroke.
- Disturbance of the sense of sight is manifested in the form of diplopic, the appearance of the net and poor vision and is the result of a spasm of central retina.
- Disorders of the sense of hearing are the result of a spasm of a. auditive and poor nutrition of cells of organ of Corti under the influence of noise and vibration as well as direct effects of vibrations that are transmitted from bones to inner ear.
- Disorders of the vestibular apparatus are manifested as vertigo, disturbed coordination of movement and disturbed maintenance of body position [15, 22].

Clinical presentation of vibration disease

High-frequency vibrations usually cause vasospasmatic changes in blood vessels. If the low frequency vibrations are accompanied by static tension of the limbs and joints neuromuscular and articular changes will be dominant in clinical picture. Clinical picture mainly develops through four stages [23].

The initial stage is manifested by mild pain and hand paraesthesia, light sensitivity disorders and moderate spasm of capillaries with rare tropic changes of shoulder muscles. These changes are completely reversible and disappear after the cessation of exposure to vibration [24].

The second stage is characterized by more prominent pain and paraesthesia, reduced skin temperature, cyanosis and increased sweating of hands. The reduced sensitivity affects fingers and entire hand, and capillaroscopy procedure shows capillary spasm. Painful infiltrations in the area of upper arm and forearm are palpable. The changes are reversible, if exposure to vibration stops immediately [13].

The third stage is characterized by marked vascular spasm and attacks of white fingers (Raunayd's syndrome), the appearance of cyanosis, swelling of the hands [25]. Sensitivity of either periphery or segment type is significantly reduced. Painful infiltrations are palpable in muscles and there occur disorders of the central nervous system. The function of cardiovascular and endocrine systems with strong neurotic reactions is disturbed. These changes are largely irreversible.

The fourth stage is characterized by a generalization of vascular disorders that affect peripheral blood vessels, coronary and cerebral circulation. Disturbed sensitivity is prominent giving a picture similar to syringomyelia. Changes are irreversible [13, 24, 25].

Clinical presentation of vibration disease induced by effects of general vibrations

The effects of general vibrations are described as cerebrovascular and spinal syndrome.

Cerebrovascular syndrome

Problems include attacks of headache, followed by nausea, vomiting, vertigo, loss of balance, dizziness and loss of consciousness. Patients are complaining of stenocardiac problems. Clinical examination shows arterial hypertension, arterial tension asymmetry with a difference of 10-15 mm Hg, and pulse asymmetry. The ECG registers signs of coronary insufficiency. Vascular changes are accompanied by signs of polyneuritis, sensitivity disorder and insufficient peripheral circulation. More prominent clinical picture shows increased tendon reflexes, tremor of fingers and nystagmus, endocrine disorders (thyrotoxicosis) with reduced sexual function [26].

Spinal syndrome

This syndrome is characterized by an organic disorder of the spinal cord and is divided into two forms

Syringomieloid form is characterized by widespread disturbances of sensitivity in the arms, shoulders and whole chest cavity, with the loss of sensitivity to pain and temperature.

Amyotrophic form is very rarely found. Along with vegetative sensitive disorders of hands signs of progressive muscular atrophy of upper extremities, shoulder region and sometimes lower extremities gradually develop. Deep reflexes weaken and disappear and pareses occur without pronounced pyramidal signs [27, 28].

CONCLUSION

Vibrations represent one of the most common physical agents present in the workplace and have a major impact on the function of many organ systems. Disorders that occur in conditions of acute and chronic exposure are numerous and many of them are very non-specific so that diseases that result from their actions are diagnosed very late. Therefore, occupational diseases induced by vibrations are very important segment in the activities of occupational medicine specialists and other medical professionals responsible for the implementation of preventive measures in the workplace. This segment of occupational exposure requires additional research and harmonization of law regulation in this area.

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PROFESIONALNE BOLESTI IZAZVANE VIBRACIJAMA

Jovanović Jovica, Đinđić Nataša, Đinđić Boris

Abstrakt: *Vibracije u radnom okruženju su fizička profesionalna noksa koja je prisutna u raznim granama industrije. Vibracije mogu delovati lokalno i opšte i mogu biti visokofrekfentne i niskofrekfentne. Vibraciona bolest predstavlja skup poremećaja i simptoma nastalih pod uticajem proizvodnih vibracija. Poremećaji su vrlo nespecifični te se bolesti koje nastaju kao posledica njihovog delovanja vrlo kasno dijagnostikuju. Zbog toga profesionalna oštećenja izazvana vibracijama predstavljaju važan segment u aktivnostima lekara medicine rada i osoba zaduženih za primenu mera zaštite na radnom mestu. U patogenezi ove bolesti glavnu ulogu igra mikrotrauma, spazam krvnih sudova, nedovoljna ishrana i ishemija tkiva i organa. Štetni efekti vibracija se ogledaju na skoro svim sistemima i organima ali su posebno ugroženi kardiovaskularni, mišićni, nervni i koštano zglobni sistem. Vibracije mogu biti faktor koji doprinosi češćoj pojavi povreda na radu. U ocenjivanju radne sposobnosti stoga treba uzeti u obzir zahteve radnog mesta, prisutne nokse, zdravstveno stanje, funkcionalno stanje organa i sistema, godine starosti, radni staž i motivaciju radnika. Preventivne mere mogu biti tehničke, medicinske, organizacione i primena ličnih zaštitnih sredstava. Ovaj segment profesionalne izloženosti zbog svog značaja zahteva dodatna istraživanja i stalno uskladjivanje zakonske regulative u ovoj oblasti.*

Ključne reči: profesionalne bolesti, vibracije, zdravlje, opasnosti.

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ZAŠTITA NA RADU U KONTEKSTU SAVREMENIH TEHNOLOŠKIH PROMENA

Abstrakt: *Tržišno ekonomske promene i globalizacija predstavljaju pokušaj da se, preko novih tehnologija, nude nove mogućnosti razvoja društva uz kontrolu proizvoda i izuma. Ali, istovremeno, to je razvoj velikih neizvesnosti u pogledu bezbednosti i očuvanja zdravlja ljudi. U tom procesu automatizacija i mehanizacija procesa rada isključuje čoveka iz neposredne delatnosti teškog fizičkog napora, ali se istovremeno uvećava njegova potreba za upravljanjem i organizovanjem procesa rada čime se uvećava psihofiziološki napor pri održavanju i praćenju promena stanja ovih tehnologija. Kako bi ostali konkurentni, u stalnom dokazavinju u procesu rada, zaposleni moraju svoj život da organizuju tako da brišu razlike između slobodnog i radnog vremena, ugrožavjući svoj ljudski integritet, a samim tim i svoju profesionalnu budućnost.*

Ključne reči: zaštita na radu, bezbednost, kvalitet.

UVOD

Period industrijske revolucije i uvođenja mašina u proizvodnju tokom XVIII veka, karakterisale su masnovne povrede i oboljevanja radnika, nedefinisano radno vreme i socijalni status, rad maloletnih lica i sl. Tada se javljaju prva zapažanja o potrebi zaštite ljudi u procesu rada i to, prvobitno, u sprečavanju povreda na radu, ograničavanju radnog vremena, regulisanju rada dece, žena i drugih pitanja iz delogruga rada. Proučavanju uzroka povreda na radu, sa naučnog stanovišta, pristupilo se u devetnaestom veku. Pokušaji određivanja pojma povreda na radu vezuju se za osiguranje za slučaj akcidenta, odnosno nezgode, nesreće[1] na radu.

Prva proučavanja išla su za tim da se otkriju neposredni uzroci koji dovode do povreda i drugih posledica ugrožavanja zdravlja ljudi, ali ne i da se stvori naučna teorija o uzrocima narušavanja integriteta čoveka u radnoj sredini.

S obzirom na preventivnu komponentu sistema bezbednosti i zaštite, sama povreda je od sekundarnog značaja. Primarno je utvrditi njene uzroke u cilju preduzimanja preventivnih akcija. Za uspešno sprečavanje nezgoda nije dovoljno proučavati samo događaje koji su imali za posledicu povredu, već i događaje koji predstalvljaju potencijalnu opasnost.

Najpoznatiji predstavnici ovih istraživačkih poduhvata su *Heinrich H. W.* [2], [3], *Neuloh O.* [4], *Neuloh J. L.* [5], *Bird F. E.* [6], [7], *Holden Z. P.* [8], *Arbous A. G., and Kerrich J. E.* [9], *Letavet, citat iz: Stanković D.* [10], i dr. Heinrich je prvi skrenuo pažnju vlasnicima kapitalističkih preduzeća na značaj sprečavanja nezgoda na radu. Sve je to u znatnoj meri uticalo na razvoj organizovanog oblika zaštite na radu, što je dovelo do formiranja različitih teorija, hipoteza o nezgodama, odnosno povredama na radu.

U istraživanjima su previše isticani pojedini elementi i pri tom zanemarivani drugi, možda značajniji, što ukazuje na to da ne postoji jedna oformljena i opšte prihvaćena teorija, već je bilo i polazište za nastajanje više teorija o nezgodama[2] na radu.

1. TEORIJE, HIPOTEZE O NEZGODAMA I POVREDAMA NA RADU

Teorije o nezgodama na radu u suštini su hipoteze, jer nisu naučno verifikovane i potvrđene[3], ali su u praksi prihvaćene kao teorije[4]. U radu se navode neke teorije koje imaju pristalice, ali koje se i osporavaju kao naučne, kao što su na primer sledeće:

Progresivna teorija o stalnoj sklonosti pojedinaca ka nezgodama na radu nastala je na osnovu rezultata istraživanja koja su vršili engleski psiholozi *Greenwood M.* i *Woods H. M.* [14] i svoja zapažanja objavili početkom XX veka. Pristalice ove teorije su i *Dunbar H. F.* [15], *Schulzinger M. S.* [16], i dr.

Henrihova teorija o nezgodama na rad, u koju je predložio *Heinrich H. W.* [3], zasniva se na modelu uzastopnih faktora koji se završavaju nezgodom.

Hepburnova teorija o uzročnom lancu, zasniva se na stavu *Hepburna,* da nezgode na radu koje su praćene

[1] *U literaturi i praksi accident kao nepланирани и неочекивани догађај (случај) који проузрокује неку негативну последицу, застој процеса рада, повређивања људи у процесу рада, карактерише се као незгода, несрећа, несрећни случај и сл. Опширније у раду: Разлике и потребе усаглашавања појмова и израза у области безбедности и заштите, Анђелковић Б. [1].*

[2] *Опширније о теоријама повређивања и истраживањима у области заштите на раду до друге половине XX века може се наћи у књизи Марковић Ж. Д. [33], Швајгер Ј. [11], Милутиновић Ј. [12] , Миљковић Ј. [13].*

[3] *Опширније о теоријама повређивања и истраживањима у области заштите на раду до друге половине XX века могу се наћи у књизи Марковић Ж. Д. [33], Швајгер, Ј. [11], Милутиновић Ј. [12], Миљковић Ј. [13].*

[4] Опширније о теоријама и њиховој научној заснованости *видети у публикацијама: Лукић, Д. Р. [29], Шешић Б. [30].*

povredoma čoveka nastaju kao posledica uzastopnog delovanja: ličnog faktora, faktora opasnosti, faktora aktiviranja opasnosti i neposrednog uzročnog faktora, *Hepburn, H. A*. [17].

Teopuja o nezgodi na radu kao epidemiološkoj pojavi, bazira se na stavovima koje zastupaju: *Farland J. A*. [18], profesor Harvardske škole narodnog zdravlja, američkih lekara; *Gordon E. J*. [19] i *Marland E. P*. [20], a koji govore o tome da se biološki zakoni kod povreda mogu da posmatraju kao i kod proučavanja bolesti, pa se one mogu sprečavati epidemiološkim metodama.

Bihejvioristička teorija o nezgodama na radu, čiji je jedan od poznatijih predstavnika *Suchman A. E.* [21], polazi od stava da se povrede na radu posmatraju u kontekstu čovekovog ponašanja.

Teopuja o nezgodi na radu kao rezultatu abnormalne razmene energije zasniva se na stavu da su grupe uzroka povreda na radu određene tipom abnormalne razmene energije i svaki tip povreda na radu je rezultat specifične razmene energije i ne može se prouzrokovati na drugi način, *Haddon W*. i dr. [22].

Teopuje o zaštiti na radu u istočnoevropskim (socijalističkim zemljama), nemaju značajnije utemeljenje. U ovim stavovima polazi se od shvatanja da čovek u socijalističkim uslovima proizvodinje treba da bude zaštićen od negativnog povratnog dejstva elemenata radne sredine i procesa rada i da zato tehnika treba da bude u službi zaštite na radu.

Na prostorima bivše SFRJ se veći broj istraživača različitih profesija bavilo analizom nezgoda i povreda na radu u tadašnjim uslovima privrednog i industrijskog razvoja, kao i analizom teorija o nezgodama odnosno povredama sa medicinskog, ekonomskog, pravnog, sociološgog i drugih aspekata posmatranja, kao što su: *Švajgr J.* [11], *Maček O.* [23], *Mihalić A.* [24], *Bujas Z.* [25], *Jovićević M.* [26], *Marković Ž. D*. [33], *Stanković Ž.* [27], *Bulat V*. [28].

Na Fakultetu zaštite na radu u Nišu odbranjeno je više diplomskih radova, magistarskih teza i doktorskih disertacija koje na direktan ili indirektan način obrađuju pitanja u vezi sa nezgodama i povredama na radu. Kao primer, u literaturi ovog rada od rednog broja [31] do [36] navodene su disertacije koje se bave ovim pitanjima.

Međutim, bez obzira na interesovanja, istraživanja i traganja za opšteprihvaćenom terijom o bezbednim uslovima rada u radnoj sredini, do danas nema takvog rešenja.

Prilazu da se čovek posmatra kao deo celine, doprineo je razvoj kibernetke i opšte teorije sistema u drugoj polovini XX veka. U tom kontekstu se analiza tehničko tehnološkog sistema razmatra u sklopu izvršavanja skupa postavljenih ciljeva, pa time i cilja ostvarivanja bezbednosti i zaštite. Bezbednost i zaštita se razmatraju u okviru sistema "čovek-tehnologija-okruženje", odnosno sistema "čovek-mašina".

2. ODNOS BEZBEDNOSTI I ZAŠTITE

Istraživanja u oblasti bezbednosti sistema, kao posebne oblasti, se javljaju 60-tih godina prošlog veka. Opširnije u radu, *Henley E. J., Kumamoto H.* [37].

Sa pojavom složenih tehničkih sistema kao što su projektili, radarski sistemi, nuklearne centrale itd. nastaje period ubrzanog razvoja teorije bezbednosti. U početku, prvenstveno se razvija zbog vojnih potreba. Tada se sreću i prve definicije bezbednosti sistema.

U praksi se pojam bezbednosti uglavnom vezivao za vojnu bezbednost, političku, civilnu, a ne na bezbednost u vezi sa radom i profesiojom. Pri tom treba imati u vidu da se pojam *bezbednosti* najpre vezuje samo za odsustvo nasilja u državi i između država, a studije bezbednosti se bave izučavanjem pretnji, upotrebe i kontrole vojne sile. Međutim, u savremenim uslovima pojam bezbednosti se shvata kao nepostojanje vojnih, političkih, ekonomskih i ekoloških pretnji *Miltojević V*. [38], odnosno kao stanje zaštićenosti vitalno važnih interesa u cilju zadovoljavanja potreba i obezbeđivanja mogućnosti progresivnog razvoja ličnosti, države i društva. Ovo je posebno od značaja ako imamo u vidu uzroke nastanka vanrednih situacija (elementarne nepogode, tehnoliške havarije i katastrofe, primena sredstava za masovno uništenje, antropogeno delovanje na prirodu), ali i posledice (ljudske žrtve, narušavanje zdravlja ljudi, uništavanje materijalnih artefakta, zagađenje, degradacija ili destrukcija prirodne komponente životne sredine). Nameće se shvatanje da je ostvarivanje opšteplanetarne bezbednosti prioritetan zadatak i cilj na globalnom i nacionalnom nivou.

Pojam ljudske bezbednosti se prvi put javlja, u međunarodnim okvirima, u Izveštaju o ljudskom razvoju Ujedinjenih nacija, 1994. godine, gde se navodi da "ideja ljudske bezbednosti, iako jednostavna, po svojoj prirodi će revolucionisati društvo 21. veka", *Dajana J. V*. [39]. Izneto je stanovište da je pojam bezbednosti preuzak, usredsređen na pretnje državi i nacionalnoj suverenosti, te da ga u buduće treba proširiti kako bi uključio pojedinca i zajednicu. U ovom smislu je pojam ljudske bezbednosti bio u skladu sa promenom kursa u ekonomskom razvoju i međunarodnom pravu sa instrumentalnih ciljeva kao što su: privredni rast, prava država na ljudski razvoj i ljudska prava.

Ljudska bezbednost se razlikuje od nacionalne bezbednosti po tome što za referentni objekat uzima ljude i zajednice, a ne državu. "Ljudska bezbednost se odnosi na uvažavanje potreba ljudi za budućnošću, tik uz potrebe država, i ona minimizuje rizike, prihvata preventivne mere za suzbijanje ljudske ugroženosti i preduzima mere oporavka tamo gde preventivne mere nisu uspele", *Dajana J. V.* [39]. Ovako poimanje bezbednosti omogućava istraživanja sa različitih stanovišta, npr. ekonomskog, tehničkog, zdravstvenog, sociološkog, socio-ekološkog idt., pa u tom smislu može da se govori o različitim tipovima bezbednosti:

vojnoj, ekonomskoj, političkoj, socijalnoj, tehničkoj, ekološkoj.

Ovde je potrebno naglasiti i odnos zaštite i bezbednosti.

Tako se u članku "Nacionalna socijetalna i ljudska bezbednost" štampanom u Zborniku tekstova " Ljudska bezbednost" *Dajana J. V.* [39] o zaštiti kaže: "ljudska bezbednost je svesno usmerena na zaštitu. Ona uzima u obzir da se ljudi i zajednice nalaze pred fatalnom pretnjom događaja koji su daleko izvan njihove kontrole: finansijske krize, nasilni sukobi, AIDS, nacionalna politika koja obezvređuje nacionana i privatna ulaganja u zdravstvenu zaštitu, teroristički napadi, oskudica vode, hronična nemaština ili zagađenja životne sredine. Negativne posledice nekih od pojava mogu da se smanje na primer kod zemljotresa izgradnjom seizmički stabilnih objekata. Pristup ljudske bezbednosti primorava mnoge institucije da obezbede institucionalizovanu zaštitu umesto povremene zaštite koja će biti u skladu sa potrebama, a ne šablonska, koja će biti preventivna a ne reaktivna".

Dalje se kaže da je ljudska bezbednost usredsređena na ljude, a ne na pretnje. Ljudska bezbednost je uslov koji proističe iz efikasne političke, ekonomske, društvene, kulturne i prirodne sredine, a ne iz vršenja niza administrativnih procedura. Ali, da bi se ljudska bezbednost održala na efikasan način, od suštinske je važnosti proaktivan odnos prema pretnji, bez obzira da li su to iznenadne pretnje, kao što su zemljotresi, ili neke tekuće pretnje sa kojima se suočavaju siromašni. Najzad pojam zaštita "treba da uključi neko osećanje zavisnosti. Bilo bi nečuveno, a i teško da se ne kaže, da se ljudska bezbednost štiti uz upotrebu sile ili na efiksan način svojstven odgovorima na pretnje nacionalnoj bezbednosti. Ali cilj ljudske bezbednosti je upravo da to čini" *Dajana J. V.* [39].

U praksi, u analizi bezbednosti koristi se veći broj metoda kao što su:

- Analiza opasnosti i radne sposobnosti (AOR),

Studije hazarda i operabilnosti (*Hazard and Operability Studies - HAZOP*), http://slp.icheme.org/hazops.html http://www.acusafe.com/Hazard_Analysis/Hazard_Analysis-HAZOP.htm

- Modeli analize posledice (*Consequence Analysis Models*),

http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1706274

- Analiza "stabla otkaza" (SO) (*Fault Tree Analysis - FTA*), http://reliability.sandia.gov/Reliability/Fault_Tree_Analysis/fault_tree_analysis.html http://www.sverdrup.com/safety/fta.pdf http://web2.concordia.ca/Quality/tools/15fta.pdf
- Stablo događaja (SD); (*Event Tree Analysis - ETA*), http://www.sverdrup.com/safety/eventtree.pdf
- Uzročno-posledična analiza; *(Failure Mode And Effects and Criticality) Analysis - FMEA/FMECA,* http://www.relexsoftware.com/reliability/fmea.asp http://www.acusafe.com/Hazard_Analysis/Hazard_Analysis-fmea.htm *Dijagram uzrok-posledica (Cause-Consequence Diagram),*
- Analiza pouzdanosti ljudskog faktora, (*Human Reliability Assessment - HRA,*
- Analiza ljudske greške (*Human Error Analysis*), Kognitivna pouzdanost i metod analize greške (*Cognitive Reliability and Error Analysis Method - CREAM*),
- Evolucija akcidenta i metod zona (*Accident Evolution and Barrier Method - AEB*),
- Sekvenciranje multilinearnih događaja (*Multilinear Events Sequencing - STEP*),
- Analiza promena (*Change Analysis*),
- Analiza odstupanja (*Deviation Analysis*),
- Analiza funkcije bezbednosti (*Safety Function Analysis*).

Sa stanovišta sistemskog pristupa i analize bezbednosti sistema na Fakultetu zaštite na radu je, takođe, urađen veći broj diplomskih radova, magistarskih teza i doktorskih disertacija. Kao primer, u literaturi ovog rada od rednog broja [54] do [60] navedene su neke od disertacija koje se bave ovim pitanjima.

3. KVALITET I RIZIK SISTEMA

Nove tehnologije krajem XX veka i globalizacija tržišne ekonomije nameću i prihvatanje pratećih pojava tih promena, kao što je slučaj sa ostvarivanjem zadatog nivoa kvaliteta radne i životne srdine. Sistem kvaliteta prema ISO standardima temelji se na tržišnoj orijentaciji. To potvrđuje i sama definicija kvaliteta kao skup svojstva i karakteristika proizvoda ili usluga, koji se odnose na njihovu mogućnost da zadovolje utvrđene ili izražene potrebe. To mora biti osnova u predstojećim promenama. Ujednačavanje uslova privređivanja na zadatom nivou kvaliteta nameće potrebu standardizovanja tih uslova.

Kvalitet sistema predstavlja željena stanja ili ishod funkcionisanja sistema, dok se nepreferentna odstupanja kvaliteta tretiraju kao gubitak odnosno šteta, *Stanković M.* i dr. [40]. Gubici mogu biti različiti: ekonomski, finansijski, politički, socijalni, ekološki, zdravstveni pa i gubici ljudskih života. Događaj koji izaziva gubitak je rizičan događaj i on je moguća posledica stanja rizika sistema.

Rezultat analize međuzavisnosti kvaliteta sistema i gubitaka upućuje na određenje rizika kao stanja u kome postoji verovatnoća pojave nepreferentne promene zahtevanog kvaliteta sistema. Ovako definisan rizik predstavlja kvalitativnu veličinu kojom se opisuju gubici. Međutim, u praksi su značajniji kvantitativni opisi veličina, pa se termin rizik najčešće koristi za očekivanu vrednost rizika koja predstavlja proizvod verovatnoće rizičnog događaja i mere gubitka njime izazvane nepreferentne promene kvaliteta sistema.

Pokušaji da se da jedinstvena definicija rizika koja bi bila pogodna u svim oblastima istraživanja nisu doveli do cilja. U različitim naučnim disciplinama prisutne su različite definicije koje istraživači usvajaju s obzirom na cilj istraživanja.

Sve ove definicije rizika sadrže dve osnovne odrednice: nedeterminisanost i gubitak, a činjenica da se o riziku može govoriti u slučaju da postoje najmanje dva ishoda jednog događaja i da najmanje jedan ishod nije poželjan, upućuje na to da postojanje više ishoda jednog događaja uslovljava nedeterminisanost, a ishod posmatranog događaja različit od željenog konstituiše mogućnost gubitka.

Često se pod rizikom podrazumeva samo verovatnoća da će se desiti neželjeni događaj, ne uzimajući u obzir posledice koje bi takav događaj izazvao. No, za potrebe odlučivanja neophodan je agregatni pokazatelj rizika koji obuhvata neizvesnost i rezultat neizvesnosti. Ako se za meru neizvesnosti usvoji verovatnoća pojave neželjenog (štetnog) događaja, a za rezultat neizvesnosti - veličina njegovih posledica, tada se rizik određuje kao „veličina" kojom se, jednovremeno, opisuju verovatnoća nastanka štetnih događaja i očekivana veličina posledica tih događaja u zaokruženom sistemu i tokom utvrđene dužine vremenskog intervala, ili tokom nekog određenog procesa, *Stanković M. i dr.* [40].

Na ovim postavkama razvijen je čitav niz metoda za procenu rizika koje su u primeni u praksi. Neke zemlje Evropske unije koriste metodologiju granskih poslovnih udruženja ili asocijacija. U Austriji se koristi metodologija Austrijske opšte ustanove za osiguranje od nezgoda (*Allgemeine Unfallversicherungsanhalt – AUVA*) i metodologija Austrijske privredne komore [41], WKO *(Wirtschaftskammer Österiech – WKO)* [42]. U Nemačkoj se primenjuje metodologija Nemačkih stručnih udruženja BG *(Der Hauptverband die gewerbliche Berufsgenosenschaften)* [43]. Za procenu rizika za mala i srednja preduzeća u Evropskoj uniji se koristi metodolgija pod nazivom SME *(Small and Medium Sized Enterprizes)* [44]. Ovu metodu izradila je Komisija zadužena za sigurnost na radu Evropske zajednice (*European Commission – Directorate General V for Employment, Industrial relations and Social Affairs, Public and Health Safety at Work Directorate*) kao pomoć za procenu stanja zaštite u malim i srednjim preduzećima. Metoda je predviđena za samoprocenu stanja zaštite u nekom preduzeću, a primenjuje je sam poslodavac.

Osnovni problem svih ovih metoda je korišćenje pokazatelja koji mogu biti zadati kvantitativnim vrednostima, kvalitativnim ocenama i kombinacijama, zavisno od toga koji se pokazatelji određuju u procesu sprovođenja procene rizika, *Anđelković B., Borjanović S.* [45].

Kada se radi o korišćenju pojmova o stvarima i predmetima koji se koriste pri proceni rizika, oni često ne daju pogodno saznanje o karakteristikama njihovih promena u prostoru i vremenu. Pojmovi stvari su zamisli relativno izdvojenih i konstantnih, posebnih delova stvarnosti. Pojam stvarnosti je uvek zamisao nečeg relativno konstantnog tj. relativno stalnog predmeta, *Šešić B.* [30].

Predmeti, pojmovi i termini izvesnih prirodnih pojava, fizičkih i drugih, su takođe relativno konstantni. Međutim, ova konstantnost kod realnih predmeta, pojmova i termina, je različita: najveća je kod termina, manja kod pojmovaa, najmanja kod samih realnih predmeta. Tako ćemo reći "zaštitne naočare zavarivača" i onda kada se naočare i pojam naočara vremenom i u različitim uslovima menjaju, *Anđelković B., Borjanović S.* [45].

Termini pojmova stvari su imenice i imena. Međutim i procesi se zamišljaju kao konstantna dešavanja i to u većoj meri nego što je to stvarno slučaj. Ovo dolazi do izražaja u terminima ovako shvaćenih procesa, a to su glagolske imenice na primer: „osposobljavanje", „upravljanje", „struganje" itd. Neposrednije zamisli procesa i njihovih adekvatnih jezičkih izraza su glagoli. Na primer: „radi", „upravlja", „kontroliše" itd. Ovi termini označavaju posebne procese. Međutim kada se radi o poimanju i jezičkom izražavanju stvari-procesa, onda se nailazi na mnoge logičke i jezičke teškoće. Ove teškoće potiču otud što je teško konstantnom mišlju i nepromenljivom rečju odrediti promenljive predmete. Ova teškoća se savlađuje time što se pojmovi stvari sve više zamenju pojmovima procesa i funkcija.

Među pojmovima stvari razlikujemo: individualne, kolektivne, klasne i kompleksne pojmove stvari. Klasčni pojam stvari je svaki opšti pojam kojim se zamišlja skup članova istovrsnih stvari ili ma koji od članova klase. Tako su „radnik", "dizalica", "stepeništa" itd. klasni pojmovi stvari.

Pored ovih, postoje i klasni pojmovi procesa i relacija. Na primer "sposoban", "obučen", "opasan", "sličnost", "razlika", "jednakost" itd. Kompleksni pojmovi su zamisli kompleksnih stvari i procesa kao što su na primer „rizik", „preduzeće", "organizam" ili pojmovi sastavljeni od više reči i simbola "radno mesto", "profesionalni rizik" itd.

Kako je kvalitet bitno obeležje stvari i procesa to su i kvalitativni pojmovi osnovni pojmovi saznanja stvari. Kvalitativni pojmovi su zamisli kvaliteta predmeta. Kvalitativni su pojmovi na primer „beo", „crn", „dobar", „loš" itd. Termini kvalitativnih pojmova su svi pridevi, sem kvantitativnih, a i ovi indirekno.

Saznanje svake stvari i procesa sastoji se u osnovi u saznanju kvaliteta stvari tj. kvalitativnim pojmovima Ovo, međutim, ne znači da su kvalitativni pojmovi i najdublji pojmovi našeg saznanja, naprotiv, u naučnom saznanju naročito onom koje se oslanja na matematiku sve veću ulogu igraju kvantitativni, relacioni i procesualni pojmovi.

Kvantitativni pojmovi su zamisli kvantitativnih odredbi predmeta, kakvi su na primer „sve", „ništa", „jedno" itd, zatim svi pojmovi numeričkog kvantiteta, tj. pojmovi posebnih i opštih brojeva i njima izraženih mera. Upotreba kvantitativnih pojmova omogućuje daleko dublja suštinska saznanja nego što su to saznanja na osnovu kvalitativnih pojmova.

Relacioni pojmovi su zamisli odnosa kako predmeta tako i ma kojih predmetnih odredaba. Svi pojmovi

„razlike“, „sličnosti“, „jednakosti“, „suprotnosti“, „protivurečnosti“ kao i bilo kog „prostornog“, „vremenskog“, „uzročnog“ i „funkcionalnog odnosa“ jesu relacioni pojmovi.

Dispozicioni pojmovi su zamisli određenosti sklonosti ili podobnosti bića ili stvari da ispolje određena svojstva u određenim uslovima, na primer, dispozicioni pojmovi su „rizičan“, „opasan“, „zapaljiv“, itd.

Suština ovih, kao i mnogo drugih teškoća sa kojima se srećemo pri oceni rizika su prisutne i u logičkoj gnoseologiji i teoriji saznanja, a koje se sastoje u dva pokušaja: 1 - u pokušaju da se, u suštini, čisto formalnim jezikom formuliše kriterijum iskaza o realnim svojstvima, o fizičkim, hemijskim i drugim faktorima i 2 – u pokušaju da se na osnovu subjektivnih kriterijuma, na primer, na osnovu opažanja utvrdi kriterijum postojanja svojstava koja nisu čisto subjektivna.

Pored navedenih teškoća kod procene rizika, sve su izraženiji uticaji novih tehnologija i tržišno ekonomskih odnosa privređivanja.

4. NOVE TEHNOLOGIJE I NOVI RIZICI

U savremenoj praksi prisutno je stanovište da su tehničko-tehnolške promene stvorile, s jedne strane, nove rizike i povećale prirodu, obim i kompleksnost tradicionalnih rizika, a sa druge strane, omogućile efikasniji način upravljanja rizicima. Međutim, postavlja se pitanje da li je pristup koji se bazira, uglavnom, na tehničko-tehnološkim rešenjima realan i primenljiv, s obzirom na koncept kvaliteta koji sadrži tri osnovne dimenzije:

1. Tržišnu - koja uvažava činjenicu da se na svetskom tržištu, u uslovima slobodne konkurencije, vodi borba za osvajanje kupaca kvalitetom proizvoda i usluga, a ne samo niskim cenama;

2. Poslovnu - jer strategija kvaliteta podrazumeva osposbljenost preduzeća sa ostvarivanje ciljeva efikasnosti, što znači sniženje troškova, povišenje produktivnosti i profitabilnosti; i

3. Kvalitet življenja - koga je najteže definisati jer zavisi od nivoa kulture jedne nacije, nivoa nauke i tehnološke razvijenosti, bruto nacionalnog dohotka, a obuhvata zaštitu zdravlja i bezbednost ljudi, zaštitu životne sredine i štednju prirodnih resursa - kao odgovor na realne pretnje koje donosi razvijeno tehnološko društvo u sukobu sa tradicijom.

Nove tehnologije i globalizacija imaju dalekosežne implikacije na tržištu rada, a pre svega na obim i strukturu rada. Globalno posmatrano, trajno su promenjeni stanje i odnosi na ovom tržištu. Ono je postalo dinamičnije nego što je bilo ranije, a stepen konkurentnosti se povećao. Tendencija je da se celokupni društveni proizvod sveta proizvodi sa sve manje radne snage. Na svetskom tržištu rada biće sve manje posla, a za taj posao konkurišu radnici iz celog sveta, zato što transnacionalne kompanije svaku svoju aktivnost za svega nekoliko dana mogu seliti u bilo koji kraj sveta.

Za sada, dobar deo rastuće nezaposlenosti prouzrokovan je globalizacijom poslovanja i tržišta rada i supstitucijom radne snage jeftinijom radnom snagom.

Generacija koja je smatrala svojim ustavnim pravom zaposlenje u državnoj ili društvenoj organizaciji prinuđena je da svoj radni potencijal izloži tržišnoj organizaciji, tržišnim zakonima, a preduzeća koja su imala tačno definisanu poziciju u lancu društvene proizvodnje prinuđena su da svoje proizvode izlože zakonitostima tržišta. Prodaje se samo ono što odgovara zahtevima kupaca, koji sve više može da bira internacionalizacijom tržišta. Menja se način života, zahtevi, ukus. Tržišna privreda donosi promene kojih možda i nismo dovoljno svesni, *Anđelković B.* [46].

Savremeni proces globalizacije uz podršku međunarodnog kapitala teži da putem koršćenja najpovoljnijih prilika i ponuda u svetu ostvari maksimalan profit. Za međunarodni kapital, nacionalni i socijalni aspekti izgubili su svaku vrednost. Isključivi kriterijum uspešnosti poslovanja savremenih kompanija je kurs deonica na svetskim berzama.

Za kapital, ljudski rad predstavlja najveći faktor troškova. Berza, kao indikator uspešnosti poslovanja, svako otpuštanje radnika ocenjuje kao uspešan poslovni potez i takavu praksu stimuliše porastom kursa deonica.

Paralelno sa procesom supstitucije rada jeftinijom radnom snagom teče i proces supstitucije rada kapitalom, tj. prava racionalizacija rada reorganizacijom i automatizacijom. S obzirom da je automatizacija zahvatila i zemlje u razvoju i da se tehnološke inovacije prebrzo događaju, većina radnika se neće moći da prilagodi promeni posla i prekvalifikacijama. To će dovesti do podele među radnicima na one koji se prilagođavaju i na one koji nisu u stanju da to čine. U tom prilagođavanju, sve je podređeno kapitalu i profitu. Nema definisanog radnog vremena, rad se obavlja od kuće, u stalnoj konkurenciji za dokazivanjem pretpostavljenima, sa neizvesnim trenutkom kada će postati višak radne snage i svrstati se u red njemu sličnih.

Tako, za sada, ostaje otvoreno pitanje da li se svet zaista kreće prema nekom stanju ograničenom u viziji društva „20:80“ („The 20:80 Society“) u kome će samo još svega 20% radno sposobnog svetskog stanovništva imati stlano zaposlenje, dok se za ostlaih 80% moraju obezbediti „hleb i igre“ („tittytainment“) radi sprečavanja socijalnih potresa. *Gereke Z.* [47].

Danas već igara svih oblika imamo u izobilju, od realnih, klasičnih sportskih događaja, do onih ekstremnih predstava koje često podsećaju na arene stare Rimske kulture, ili onih osmišljenih po principu *realitty shou,* kao i onih virtuelnih, dostupnih u svim sredstvima komunikacija. Ostaje nam ponuda hleba dobijenog iz nekog od oblika genetski modifikovanih sirovina.

Dakle, i pored evidentnih prednosti nisu zanemarljivi ni rizici koje ove tehnologije donose pojedincu i čovečanstvu. Oni se mogu obreti u društvu blagostanja i slobode, što ove tehnologije teorijski i praktično čine dostupnim, ali mogu da završe i u nekom poretku tlačenja, represije i neslobode, što nove tehnologije, takođe, čine mogućnim.

ZAKLJUČAK

Jedna od osnovnih odrednica Statuta Međunarodne organizacije rada je, "zaštita od bolesti, oboljenja i povreda, do kojih dolazi usled obavljanja radnih aktivnosti". Prvobitno, osnovni cilj zaštite u okvru Međunarodne organizacije rada odnosio se na unapređenje najnepovoljnijih uslova rada, sa aktivnostima ka smanjenju broja povređivanja radnika i profesionih oboljenja. Prvi međunarodni standardi i norme odnosile su se na najizraženije zloupotrebe u oblasti rada kao što su: zapošljavanje maloletne dece, prekomerna dužina radnog vremena, zaštita materinstva, rad žena i dece noću, zaštita od fizičkih, hemijskih i drugih opasnosti.

Sledeći korak su bila pitanja socijalne zaštite i nadoknade zbog povreda na radu i profesionalnih bolesti, što je neposredno dovelo do razvoja preventivnih mera. U drugoj polovini XX veka razvoj u oblasti zaštite posebano se odvija u oblasti bezbednosti i zdravstvene zaštite radnika i dobija nove oblike neposredne saradnje između Međunarodne organizacije rada i Svetske zdravstvene organizacije.

U tržišnoj ekonomiji proizvođači, prodavci, kupci deluju samostalno u uslovima konkurencije, tj. na svoj rizik. Njihova finansijska budućnost je zbog toga nepredvidiva i teško se može prognozirati.

S tog stanovišta zaštita na radu mora da se razmatra sa prvobitnih polazišta socijalne bezbednosti i prava na rad, a da uloženi rad kao kapitalna vrednost i kao kapital tržišta, bez uvažavanja kriterijuma socijalne izvesnosti, gubi smisao, bez obzira na tehničko-tehnološka dostignuća u pogledu fizičke bezbednosti i kvaliteta sistema.

Razvoj novih tehnologija i globalizacije upućuju na to da se zaštita na radu vraća na prvobitna polazišta industralizacije i potrebu zaštite socijalnih interesa: prava na rad, dužine radnog vremena i odmora, odnosno društvenog statusa radnika, jer tehničko-tehnološka rešenja u zaštiti na radu ne uključuju komponente socijalne izvesnosti.

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[43] BG - Die gewerblichen Berufsgenossenschaften , BIA - GESTIS-Stoffdatenbank, http://www.hvbg.de/d/bia/fac/stoffdb
[44] SME (Safety and Health for Small and Medium sized Enterprises) Workshop on risk assessment for SMEs - Belgium, http://sme.osha.eu.int/publications/assistance_scheme/2002/en/index_11.htm -
[45] *Anđelković B., Borjanović S.,* Procena rizika na radnom mestu, Svet rada, Ekocentar, Beograd, 2005, Vol. 2, br. 4, str. 659-669.
[46] *Anđelković B.,* Obrazovanje kadrova za bezbedan rad i kvalitet radne i životne sredine, VIII Kongres inženjera i tehničara Jugoslavije, 30-31. oktobar 1997. godine, Tehnika, , Savez inžinjera i tehničara Jugoslavije, 1997, Godina LI, br. 9-10, str. 121-127.
[47] *Gereke, Z.,* Ekologija i organizacija, Znamen, Beograd, 1995.

BIOGRAFIJA

Branislav Anđelković je rođen u Grabovnici kod Kuršumlije, 1950. godine. Doktorirao je na Fakultetu zaštite na radu u Nišu, gde je i zaposlen na radnom mestu redovnog profesora za užu oblast Bezbednost i rizik sistema. Napisao je veliki broj naučnih i stručnih radova. Više puta je bio član organizacionih odbora naučnih i stručnih skupova, redakcionih odbora i programskih odbora, kao i predsednik Organizacionog odbora naučnog skupa „Tehnološki rizik i životna sredina“, Profesionalni rizik-teorija i praksa 2003, 2005 i 2007. Učesnik je većeg broja naučno istraživačkih projekata.

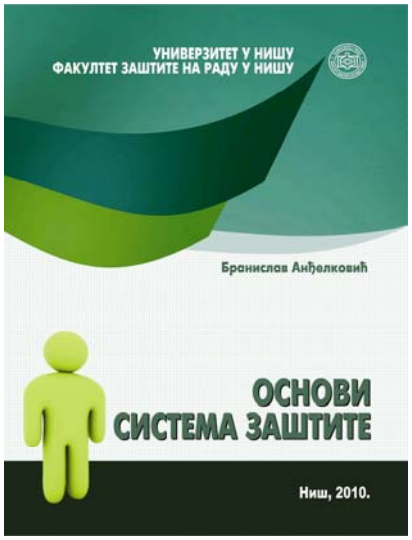
OCCUPATIONAL SAFETY IN THE CONTEXT OF MODERN TECHNOLOGICAL CHANGES

Branislav Anđelković

Abstract: *Economic and market changes, as well as globalization represent new possibilities for the society development through modern technologies, and through the control of products and inventions. Yet, simultaneously, this is the development of large uncertainty regarding occupational health and safety. In the process of automation and mechanization, work processes exclude man from the activity and heavy physical work, but at the same time, they increase his need for management and organization of work processes, thus increasing psycho-physiological load while maintaining and monitoring the changes of these technologies. To remain competitive, the employees should show excellence in work and they must organize their lives in a way that there should be less differences between free time and working hours, thus jeopardizing their human integrity, and therefore, their professional future.*

Key words: occupational safety, quality.

BOOK REVIEW / PRIKAZ KNJIGE



OSNOVI SISTEMA ZAŠTITE

Branislav Anđelković

Specijalizacija nauka i produbljivanje sve užih područja istraživanja doveli su do gubitka predstave o celini istraživanih problema, kao i do ozbiljnih problema sporazumevanja, čak i u okviru istih nauka. Ublažavanju, a kasnije i prevazilaženju posledica ovakvog razvoja nauka, bitno je doprinela opšta teorija sistema. U proučavanju sistema opšta teorija sistema koristi sistemski pristup kao metodološki pristup naučnom istraživanju, sistemsko mišljenje kao osnovu sistemskog pristupa i sistemsku analizu kao metodološki postupak saznavanja sistema.

U svojoj knjizi „Osnovi sistema zaštite“ autor dr Branislav Anđelković polazi, upravo, od postavki, principa i zakonitosti opšte teorije sistema, te u opisu i analizi zaštite radne i životne sredine primenjuje sistemski pristup. Posebno ističe značaj sistemskog pristupa u istraživanju kompleksnih sistema kakvi su, npr. tehnološki sistemi, sistem radne sredine i sistem životne sredine. Naime, osnovu izlaganja u knjizi čini odnos tehnološki sistem - radna sredina - životna sredina. Navedeni sistemi definisani su u odnosu na cilj posmatranja - očuvanje performansi kvaliteta uvođenjem odgovarajućih sistema zaštite. Promene u ovim sistemima, odnosno transformacije ulaznih u izlazne veličine i karakteristike, razmatraju se u odnosu na izmenu materijalno energetskih tokova.

S obzirom da se kvalitet ovih sistema definiše i analizira sa aspekta uloge i potreba čoveka, posebno poglavlje je posvećeno čoveku, njegovim interakcijama i odnosima sa drugim elementima tehnološkog sistema, sistema radne sredine i sistema životne sredine. Analiziraju se psihofizičke karakteristike i opterećenja čoveka u okviru materijalno - energetskih i informacionih tokova, koji se ostvaruju pri realizaciji funkcija cilja posmatranih sistema. Posebno se razmatraju negativne posledice radnih aktivnosti u radnoj i životnoj sredini.

Negativne posledice rada i radnih aktivnosti se odražavaju na ugrožavanje zdravlja ljudi, radom stečenih i prirodom stvorenih vrednosti, što dovodi do promena stanja i performansi kvaliteta sistema. Stoga se posebno razmatraju opasnosti i rizici prisutni u ovim sistemima, kao i aspekti zaštite koji doprinose održavanju i unapređivanju njihove bezbednosti. Prikazane su karakteristike rizika tehnoloških sistema, profesionalnih rizika i udesnih rizika, dat je pregled metoda za identifikaciju i ocenu rizika, kao i pregled kvalitativnih i kvantitativnih pokazatelja (karakteristika, indikatora), koji se koriste u analizi bezbednosti i rizika sistema.

Posebno su razmatrani sistemi zaštite na radu, zaštite od požara, zaštite životne sredine, upravljanja vanrednim situacijama i upravljanja komunalnim sistemima.

U okviru poglavlja koje se odnosi na *sistem zaštite na radu* polazi se od osnovnih pojmova zaštite na radu, bezbednosti i zaštite zdravlja ljudi u radnoj sredini. Razmatraju se nadležnosti i dokumenta koja donose međunarodne organizacije, u prvom redu Međunaroda organizacija rada. Takođe se daje prikaz institucija i organa Evropske unije, njihov razvoj i nadležnosti u donošenju dokumenta u oblasti zaštite na radu.

U razmatranju *sistema zaštite životne sredine* autor polazi sa stanovišta da su negativne promene u životnoj sredini uslovljene neusklađenim tehničko-tehnološkim razvojem i populacionim rastom stanovništva. Navodi teorije o životnoj sredini karkteristične za drugu polovinu XX veka. Razmatra osnovne nadležnosti i dokumenta koja donose međunarodne organizacije, institucije i organi Evropske unije u oblasti zaštite životne sredine.

Zaštita od požara i upravljanje vanrednim situacijama danas zauzimaju značajno mesto. Stoga su opisani međunarodni i nacionalni nivoi organizovanja, kao i subjekti u sistemu zaštite od požara i sistemu upravljanja vanrednim situacijama.

U okviru dela koji se odnosi na *komunalne sisteme* razmatraju se delatnosti, zatim poslovi i zadaci po deletnostima i na nivou lokalnih samouprava, kao i nadzor nad realizacijom komunalnih proizvoda i usluga.

Sadržaj materije je izložen na jasan i razumljiv način, a poglavlja tako strukturirana da predstavljaju zaokružene celine izložene logičkim redosledom. Kroz analizu osnovnih elemenata, veza i uticaja tehnološkog sistema i sistema radne i životne sredine, uzroka degradacije ovih sistema, kao i različitih sisteme zaštite, ova knjiga upućuje na efektivne načine i postupke zaštite radne i životne sredine.

Prof. dr Suzana Savić
Fakultet zaštite na radu u Nišu

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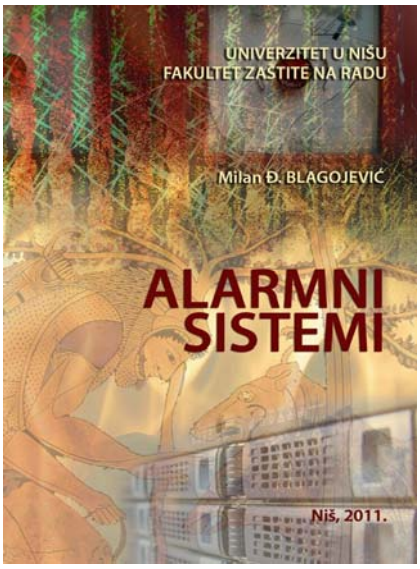

ALARMNI SISTEMI
monografija

Milan Blagojević

- Izvod iz predgovora -

... Tekst ovog rukopisa je nastao na osnovu predavanja koje je autor držao iz predmeta *Sistemi za otkrivanje i dojavu požara*, iz predmeta *Alarmni sistemi* u okviru diplomskih akademskih studija i jednog dela predavanja iz predmeta *Tehnički sistemi zaštite* u okviru osnovnih akademskih studija na Fakultetu zaštite na radu u Nišu. Takođe, za knjigu su iskorišćena i predavanja koja je autor držao na Kriminalističko – policijskoj akademiji u Beogradu iz predmeta *Sistemi fizičko tehničke zaštite* na Specijalističkim studijama. Svakako da ovaj tekst mogu koristiti i studenti drugih fakulteta, kao i svi oni koji se bave različitim aspektima bezbednosti i zaštite lica, imovine i poslovanja.

Monografija pod nazivom "ALARMNI SISTEMI" ima ukupan obim od 322 strane kucanog teksta formata B5 sa 181 slikom, 46 tabela i spiskom korišćene literature i web stranica koji sadrži ukupno 146 jedinica.
Tekst monografije, posle predgovora i sadržaja je sistematizovan u 3 celine sa ukupno 25 poglavlja:

Deo I - Opšte o alarmnim sistemima

0. Uvod
1. Istorijat
2. Sistemi za prikupljanje podataka
3. Senzori i detektori (javljači)

Deo II - Sistemi za dojavu požara

4. Detekcija parametra požara
5. Detektori (javljači) požara
6. Ručni javljači požara
7. Detektori toplote
8. Detektori dima
9. Detektori plamena
10. Detektori ugljen-monoksida
11. Višesenzorski (višekriterijumski) detektori
12. Organizacija sistema za dojavu požara
13. Projektovanje sistema za dojavu požara

Deo III - Sistemi za zaštitu od provale

14. Sistemi za zaštitu od provale
15. Alarmni kontakti
16. Detekcija loma stakla
17. Ultrazvučni detektori pokreta
18. Mikrotalasni detektori pokreta
19. Infracrveni detektori pokreta
20. Kombinovani detektori pokreta
21. Detektori prisustva
22. Zaštita perimetra
23. Organizacija sistema za zaštitu od provale

24. Literatura

- Izvodi iz recenzija -

... Sadržina rukopisa pokazuje da se radi o opsežnom, metodološki dobro osmišljenom tekstu koji je originalan u smislu sagledavanja problematike alarmnih sistema i mogućnosti njihove primene u našim uslovima. Korišćenje literature na različitim jezicima ukazuje na autorov komparativni pristup problemu koji je bio neophodan kada se ima vidu nedostatak ne samo domaće literature na ovu temu, već i odgovarajuće zakonske regulative iz ove oblasti.

... Rukopis pruža celovit uvid u problematiku alarmnih sistema. Izložena materija može, osim upoznavanja teorijskih postavki načina realizacije pojedinih komponenti i sistema u celini, da obezbedi i primenu prikazanog sadržaja u procesu projektovanja i implementacije alarmnih sistema.

Prof. dr Dejan M. Petković
Fakultet zaštite na radu u Nišu, Univerzitet u Nišu

... Na osnovu izloženog može se zaključiti da rukopis "ALARMNI SISTEMI", autora dr Milana Đ. Blagojevića, vanrednog profesora Fakulteta zaštite na radu u Nišu, svojim sadržajem, metodološkim pristupom i obimom, predstavlja značajan doprinos izučavanju problematike alarmnih sistema u našoj zemlji.

Prof. dr Radovan V. Radovanović
Kriminalističko-policijska akademija u Beogradu

Report on the First International Conference on Radiation and Dosimetry in Various Fields of Research (RAD 2012)

In the period from April 25 until April 27, 2012, the Faculty of Electronic Engineering in Niš and the city of Niš were the hosts of The First International Conference on Radiation and Dosimetry in Various Fields of Research (RAD 2012). The Conference was organized by the Faculty of Electronic Engineering in Niš in cooperation with Tyndall National Institute, Cork, Ireland and Jožef Stefan Institute, Ljubljana, Slovenia, and was supported by and organized as a part of the FP7 Project: Joint Research on Various Types of Radiation Dosimeters (RADDOS). The conference was also supported by the Ministry of Education and Science of the Republic of Serbia.

Since this was the first conference, the aim of the organizers was to attract researchers from different scientific fields and provide the forum for researchers and professionals involved with radiation and radiation dosimetry to exchange and discuss their findings and experiences. The fields covered by the Conference were physics, electronics, medicine, biology, environmental protection, and other areas related to ionizing and non-ionizing radiation and their detection. As a result, RAD 2012 Conference gathered more than 150 participants from more than 30 countries from all around the globe.

The scientific part of the conference consisted of invited lectures, oral and poster presentations, and it also included special lectures and round tables. This turned out to be an excellent forum for discussing and exchanging experiences of professionals and researchers from all over the world. The conference was further enriched with the presence of two internationally known companies (Epsilon Landauer Dosimetry Technologies from Turkey and Canberra Packard Central Europe GmbH. from Austria) which, as exhibitors, presented the technologies and products they have in offer. On the other hand, a large number of interesting social events allowed the participants to take a break from the sessions, enjoy, bond with each other and exchange ideas in a more relaxed atmosphere. For more information about RAD 2012 Conference, you can visit the conference website www.rad2012.elfak.rs where you can also download the Book of Abstracts, the Conference Proceedings and the Conference Program.

Having in mind that this was the first RAD Conference, it could be said that it was very successful based on the number of participants from all around the world, the number of published abstracts in the Book of Abstracts (approximately 200 abstracts) and the number of full-papers published in the Conference Proceedings (100). Moreover, the organization of the conference was excellent and on a very high level, and the social events greatly contributed to the relaxation and bonding of the participants, thus making ground for further contact and cooperation. Since this is a biannual conference, the Conference Chairman, prof. dr. Goran Ristić, invited all the participants to be a part of and attend The Second International Conference on Radiation and Dosimetry in Various Fields of Research (RAD 2014), May 28-30.

CONFERENCE ANNOUNCEMENT

23rd National & 4th International Conference „NOISE AND VIBRATION“

Following the success of the previous conferences, The University of Niš, Faculty of Occupational Safety and “Politechnica” University of Timisoara, under auspices of the Ministry of Education and Science of the Republic of Serbia, organize 23rd National Conference & 4th International Conference “Noise and Vibration" in Niš, Serbia, 17 - 19 October, 2012. The Organization Committee is pleased to invite the scientists and engineers from university research centers and industries, working in all fields of noise and vibration, to present their contributions in the form of oral communications or posters. The main objective of this Conference is to provide international forum with advance scientific knowledge about the noise and vibration.

SCIENTIFIC FIELDS

The authors are invited to contribute with the original unpublished papers on theoretical results or innovative applications. Major topics of interest will be focused on, but not limited to the following:

- Noise generation and propagation
- Noise control
- Environmental noise
- Vibration generation and propagation
- Vibration control
- Effect of noise and vibrations
- Analysis of noise and vibration
- Requirements

ABSTRACT SUBMISSION

Abstracts of papers proposed for presentation at the Conference will be reviewed by the Program Committee. Each abstract should be written on an A4 paper format, 300 words maximum, in both English and Serbian (authors from abroad should submit English copy only). The abstract should include: the title of the paper (20 words maximum), the authors' names, affiliation, full addresses, telephone numbers, fax and e-mail. The authors are invited to classify their papers according to the scientific fields of noise and vibration listed previously. A copy of the abstract should be sent to the Conference Secretariat by post or e-mail, no later than June 1, 2012. Authors will be informed about the decision of the Program Committee by June 30, 2012. A complete manuscript will be printed in the Conference Proceeding and must be received not later than September 1, 2012. Detailed instructions for preparing a camera ready manuscript will be sent to all authors of accepted papers.

LANGUAGES

The official language of the Conference is English.

WORKSHOPS & EXIBITION

During the conference, two workshops will be organized. The workshop themes and the moderators will be defined subsequently. Workshops will be held in English.

Companies and institutions are invited to present their achievements in developing devices and materials, protection technique and instrumentation in the field of noise and vibration. Exhibition, booth and table reservation are available at the Conference Secretariat.

IMPORTANT DATES

Deadline for abstracts	June 1, 2012
Notification of acceptance	June 30, 2012
Deadline for papers	September 1, 2012
Program publishing	September 20, 2012

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ЧАСОПИС ЗА ЗАШТИТУ НА РАДУ, ПРАВНУ, ЗДРАВСТВЕНУ, ЕКОЛОШКУ И ЗАШТИТУ ОД ПОЖАРА

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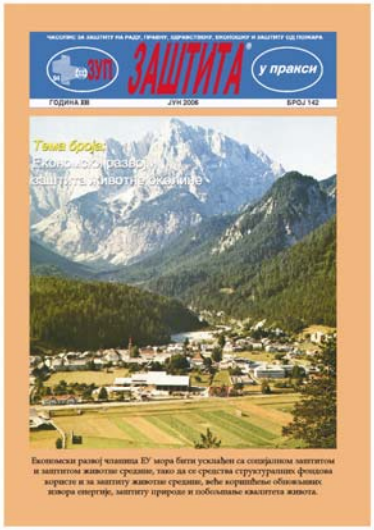
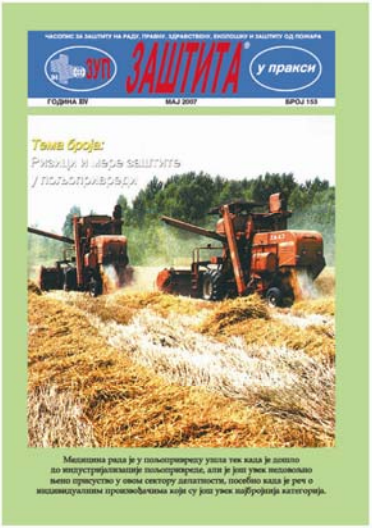
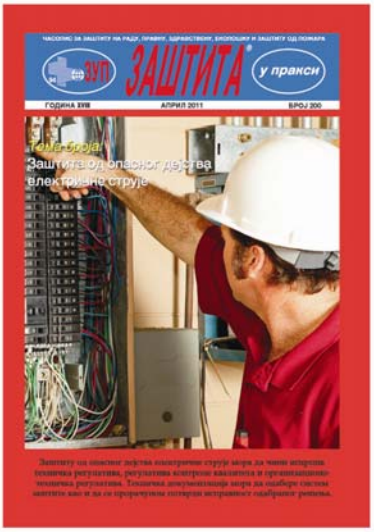
ГОДИНА ПУНОЛЕТСТВА





Месечни стручни часопис за заштиту на раду, заштиту од пожара, медицину рада и заштиту животне средине је једини часопис који покрива ове области у Србији. Први број "ЗАШТИТЕ У ПРАКСИ" изашао је 18. јуна 1994. године. Са својих 18 година и преко 200 изашлих бројева стекао је пунолетство и оправдао поверење свих посленика из ових области. Све радове које објавимо се хоноришу. У нашој кући постоји место за све оне који су заинтересоване за сарадњу како бисмо постали још квалитетнији.



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MILLER

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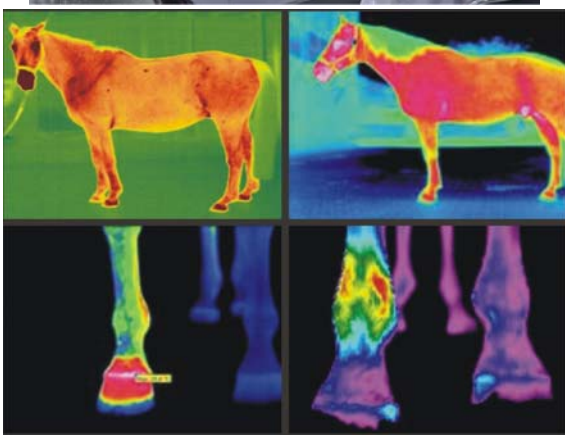
EasIR Serija i EasIR-9

EasIR Serija je nova infracrvena kamera proizvođača Guide, koja pomera granice infracrvenog snimanja svojim odličnim karakteristikama i niskom cenom. Dizajnirana je za rad pod teškim radnim uslovima i za korisnike, koji ne moraju biti visoko obučeni, EasiR Serija je otporna na udarce i robus tna i pod najtežim radnim uslovima.

Za medicinu
Termovizijske kamere vrlo lako i precizno detektuju detektuju temperatune razlike pojedinih delova površine tela čoveka i životinja i mogu se koristiti u mnogim medicinskih granama kao u epidemiologiji, virusologiji, reumatologiji, hirurgiji, dijagnostici kancera, metaboličkih bolesti, vaskularnih promena, stomatologiji, kao i za otkrivanje različitih bolesti i pre nego što su doživeli punu kliničku sliku pa je značajna njena uloga u ranom otkrivanju i prevenciji.



Za zaštitu od požara, zaštitu radne i životne sredine
Protivpožarna ručna termička kamera IR1190 je opremljena sa detektorom ultravisoke rezolucije, što joj omogućuje prikazivanje slike besprekorne jasnoće, a time se pomaže vatrogascima da vide kroz oblake dima i da identifikuju moguće žrtve pre nego što do dođe do povrede, ili smrti

Napredna tehnologija infracrvenog merenja temperature vam pomaže da odredite tačan izvor vatre, a time da donesete tačnu i blagovremenu odluku, koja neće biti ugrožena od strane nepreciznosti merenja detektora. Na raspolaganju je i bežični prenos video informacija, kojim se može ostvariti slanje žive slike iz prve ruke u komandni centar, gde se onda mogu doneti brze i precizne odluke.

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