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NEW AND INCREASING OCCUPATIONAL AND INDUSTRIAL HAZARDS

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Abstract. In the recent decade a number of new and increasing hazards arose in the industry world-wide. Some of them can be attributed to the occupational field and some must be considered as hazards capable to initiate serious industrial accidents. In this paper, a review of occupational and industrial hazards is provided. The attention is focused on biological, chemical, physical hazards as well as psychosocial issues. Equipment aging, creation of networks and nanotechnologies are considered to be new and increasing industrial hazards. A separate consideration is devoted to the presence new and increasing hazards in Lithuanian industry. It is found that these hazards exist but are not very topical because Lithuania does not run highly dangerous technologies, plants and industrial branches which are hazardous to environment. A number of new and increasing hazards specific to Lithuanian industry are identified and analyzed. The consideration can provide recommendations for the companies which may face new and increasing hazards.

Keywords: occupational hazards, industrial hazards, new and increasing hazards, new technology.

1. Introduction

The evolution of society and the changing world of work bring new risks and challenges for workers and employers (Reinhold and Tint 2009). Working environments have changed considerably during the last decades and are continuing to evolve as a result of (OECD 2003; EASHW 2005): (i) changes in the structure of the workforce related to the ageing workforce and increasing participation of women; (ii) changes in the structure of the labour market due to globalisation and growth of the service sector; (iii) new forms of employment and jobs; (iv) the intensification of work; and (v) the introduction of new technologies and work processes.

According to Eurostat 2007 3.2 % of the persons in the EU27 of 15-64 years that worked or had worked during the past year had one or more accidents at work in the past 12 months (Eurostat 2007). This percentage corresponds to 6.9 million persons in the EU27. In total, 0.4% of all respondents had two or accidents, which corresponded to approximately 0.8 million persons. This means that one worker became a victim of an industrial accident every 5 seconds and one worker died every two hours. All industry sectors are concerned: manufacturing, energy, transport, construction, agro-industry, process industry (Fairhurst 2003).

After Lithuania became a part of global and European Union market, all afore mentioned occupational and industry hazards occur in this country as well. Current purpose of the environment protection in Lithuania is to implement the principles of sustainable development ensuring healthy natural environment, saving landscape and biological diversity while optimizing nature utility. In this environmental strategy the problems of water and air are highlighted, by paying attention to all targets in order to achieve priority goals in other environment areas as well.

The aim of this paper is to provide a short review of new and emerging occupational and industrial hazards. In addition, proneness of Lithuanian industry to these hazards is assessed. The aspiration of the paper is to draw attention of industrial players in Lithuania to the existence and unfolding of the new and emerging hazards.

2. New and increasing hazards

New technologies, manufacturing processes, and disassembly techniques often bring with them newly emerging occupational safety and health concerns (Table 1). Recent examples include workplace use and production of genetically modified organisms and nanotechnology. There is growing concern about the exposure to various toxins in the disassembly of electronic waste as well.

Due to the increasing complexity and interdependencies of industrial systems as well as global (political) disturbances, there is an urge to emphasise emerging and cross-cutting hazard and safety issues that are not traditionally covered under the terms “occupational safety”

and "industrial safety". Emerging hazards are considered as both "new" and "increasing", and a multitude of trends, developments, driving forces and obstacles affects the nature of hazards and the context in which they are managed (OECD 2003; EASHW 2005). The hazard is considered "new" if:

- The hazard was previously unknown and is caused by new processes, new technologies, new types of workplace, or social or organisational change (e.g., hazards linked with nanotechnology, biotechnology, information and communication technologies, new chemicals, etc.); or,
- A long-standing issue is newly considered as a hazard due to a change in social or public perceptions (e.g., stress, bullying); or,
- New scientific knowledge allows a long-standing issue to be identified as a new hazard (e.g., in the situations where cases have existed for many years without being identified as hazard because of lack of scientific knowledge).

The hazard is "increasing" if the:

- Number of hazards leading to the risk of an accident is growing; or
- Likelihood of the exposure to the hazard leading to the hazard is increasing, (exposure level and/or the number of people exposed); or
- Effect of the hazard on workers' health is getting worse (e.g., seriousness of health effects and/or the number of people affected).

The potential of new hazards requires develop knowledge and solutions to solve the new problems, new technologies, new processes, new materials, new work organisations and work force, like for instance those related to (but not limited to):

- New/emerging technologies (e.g., nanotechnology, biotechnology, etc.);
- New materials and chemicals;
- Energy (e.g., renewable energy technologies);
- Interlinking and interaction between industrial safety and natural hazards (e.g., natural hazards triggering threat to industrial safety);
- Information and telecommunication technologies;
- New characteristics of work force and work organisation (e.g., networks, industrial parks and other interdependencies);
- Transportation of hazardous goods and materials;
- Banking and finance;
- Power and water systems and other utilities;
- Emergency services, both governmental and private;
- Prevention strategies development, testing, and their socio-economic assessment;
- Future trends of economical and competitiveness-related aspects of hazards and risk management (e.g., in cases when the decision is to build a new plant rather than "retrofitting" the old/existing one);
- Attacks on and against industrial installations (security aspects in safety of industrial plants);
- Globalisation.

Table 1. Examples of emerging hazards (ETPIS 2006: 134)

The area posing hazards	Example of hazards
Health	Hazards of artificial organs
Food, agriculture and biotechnology	Hazards related to long-term effects of genetically modified food
Information and communication technologies	Hazards of crashes of large-scale information and communication technology systems
Nanosciences, nanotechnologies, materials and new production technologies	Toxicology and explosibility of nanoparticles
Energy	Long term hazards of renewable technologies
Environment (including climate change)	Interaction between nature and technology hazards/disasters
Transport (including aeronautics)	Hazards related to transportation of new hazardous materials by new means of transportation
Socio-economic sciences and the humanities	Societal hazards related to possible failures of critical industrial plants and systems
Security and space	Hazards related to "garbage" in space, or hazards related to terrorists' attacks on industrial installations

Another dimension of the new hazards is related to the "globalised" market. For instance, toady it is a usual practice that industrial plants have multiple and combined vendors, suppliers or subcontractors. During the life time of a plant they may be "disappearing" in mergers and acquisitions, and communication to them may be hampered due to language barriers. The use of the web can bring additional challenges to the dissemination and making available of confidential or sensitive data. That all can end up by putting the risk assessor/manager in front of insurmountable problems.

The future management approaches to the emerging and cross-cutting hazards must capture the interdependencies and interactions among the complex systems, and the increasingly important international dimensions.

The following sections of this paper were written with the intention to provide a detailed explanation of top new and increasing occupational and industrial hazards. Although boundaries between both kinds of hazards do not exclude a combination of them, they are considered separately in order to simplify our analysis.

3. Occupational hazards

A survey carried out by the European Agency for Safety and Health at Work (EASHW) identified four principal groups of new and increasing occupational hazards (EASHW 2007a). Although the names of these hazards – biological, chemical, physical and psychosocial ones – is are well-known, some types of them are considered to be an increasing problem.

3.1 New biological risks

Biological agents are ubiquitous in almost all occupational environments. Many workers face very harmful biological risks. About 320000 workers worldwide die every year of communicable diseases (EASHW 2007a). Many global factors contribute to the increasing presence of biological agents at workplaces and in everyday life outside the work. EASHW list of the top emerging biological risk was compiled by (EASHW 2007a, b):

Global epidemics: most at risk workers are those in contact with infected animals. Workers involved in global trade and those exposed to infected people such as healthcare staff and aircrews are high-risk groups.

Drug-resistant organisms: healthcare workers and workers in contact with animals are at risk due to the emergence of antimicrobial-resistant organisms.

Poor assessment of biological risks: despite the obligation to assess biological risks laid down by the directive 2000/54/EC, knowledge and information about biological risks is still relatively undeveloped. In practice, a proper assessment of biological risks is difficult.

New and complex exposure situations in waste treatment industry: the major health problems observed in workers are caused by bioaerosols, which contain a variety of airborne microorganisms and volatile organic compounds. Handling medical waste and sharps may lead to other infections, including hepatitis and human immunodeficiency virus infection (HIV).

Poor indoor air quality: airborne moulds are ubiquitous in traditional workplaces, such as offices. Exposure to moulds can lead to asthma, upper respiratory tract diseases, headaches, flu-like symptoms, infections, allergic diseases, and irritation of the nose, throat, eyes and skin, and contribute to the sick building syndrome. Airborne moulds are also found in waste and sewage treatment, cotton mills, and the agricultural sector.

Exposure to endotoxins: endotoxins can be found in all occupational settings where organic dust is present. Those at risk include workers in the livestock industry, workers in waste and sewage treatment, and even indoor workers. The clinical effects range from fever to septic shock, organ failure and even death.

Combined exposure to biological agents and chemicals: if the risks from biological agents are difficult to assess, those resulting from combined exposure to biological agents and chemicals pose even more problems. While the range of potential health effects is wide, it is difficult to determine which of these constituents accounts for which health effects.

Identification of increasing and new biological hazards reveals the fact that there are still lack of information and knowledge in this field. Along with all abovementioned biological hazards and growing number of key players, chemical hazards appear in this area. Present situation requires finding solutions for complex problems.

3.2. Top emerging chemical risks

Exposure to dangerous substances in the workplace can cause many different types of harm: cancers, reproductive disorders, damage to the nervous system, respiratory disorders, skin diseases and infectious diseases. The effect done by dangerous agents can occur not only from a single short exposure but also by the long-term accumulation of substances in the body. Emerging chemical risks are:

Nanoparticles: can cause toxicity, cardiopulmonary effects, modification of protein structures, autoimmune effects, oxidative stress, and cancers.

Diesel exhaust: is the fourth most common carcinogen found in the workplace and may cause lung cancer as well as non-cancer damage to the lung.

Man-made mineral fibres: continuously evolving fibrous materials, the inhalation of which increases inflammatory, cytotoxic, and carcinogenic potential – the longer and thinner the fibres, the more dangerous they are.

Allergenic and sensitising agents: new epoxy resins with enhanced properties (e.g., for the manufacture of adhesives, paints, coatings and polymer composite structures) may introduce unknown adverse health effects. Epoxy resins are a major cause of occupational allergic contact dermatitis.

Carcinogens, mutagens and reprotoxic substances: asbestos, crystalline silica, wood dust, organic solvents, endocrine disruptors, persistent organic pollutants, aromatic amines, biocides, azodyes, and combined exposures to several carcinogens were identified as emerging risks. No fewer than 32 million people in the European Union are exposed to such carcinogens at levels considered unsafe. About 95 500 fatal cancers each year could be work-related, which would make cancer one of the main occupational causes of death.

Sector-specific chemical risks: dangerous substances in the construction sector and in waste treatment were highlighted as emerging risks. The illness rate is 50% higher in waste workers than in other sectors. High levels of dust and over 100 volatile organic compounds (VOCs) were found. Electrical and electronic equipment and end-of-life vehicles are increasingly being recycled and contain lead, cadmium, mercury and polychlorinated biphenyls (PCBs).

Combined risks: in addition to mixed dangerous substances, combined chemical and psychosocial hazards were identified as emerging ones (e.g., poor control of chemical hazards in SMEs and increasing subcontracting practices, e.g. in maintenance and cleaning, whereby subcontracted workers are less aware of chemical hazards and hence more vulnerable to dangerous substances).

Considering each risk factor independently may lead to an underestimation of the real risks to workers (EASHW 2007b; Commission of the European Communities 2001).

Apart from biological and chemical hazards, physical hazards and agents applier as new and increasing ones. This is due to ubiquitous presence of these hazards. Most of them are well known; however, an increasing magnitude of these hazards is observed in many workplaces.

3.3. Physical hazards at workplaces

Although physical hazards and agents are well known to employers and workers, some of them must be considered relatively new and increasing. This is due to new technologies, shifting economic and social conditions, workplaces, work practices and production processes. These new work situations bring new risks and demand of new approaches that ensure high levels of safety and health at work. The top emerging new physical risks:

Lack of physical activity: the causes identified are the growing use of visual display units (VDUs) and automated systems resulting in prolonged sitting at the workplace, as well as the increasing time spent sitting during business travel. A literature review showed that occupations with very little physical activity and increased prevalence of musculoskeletal disorders (MSDs) usually involve prolonged sitting, but workplaces where there is prolonged standing are also a concern. The health outcomes are MSDs of the upper limbs and of the back, varicose veins and deep-vein thrombosis, obesity and certain types of cancer.

Combined exposure to MSD and psychosocial risk factor: unfavourable psychosocial aspects are seen to accentuate the effects of physical risk factors and contribute to an increased incidence in MSDs. The literature focuses on VDUs and call centre jobs and on the healthcare sector. The psychosocial factors mentioned are too high or too low job demand, complex tasks, high time pressure, low job control, low decision level, poor support from colleagues, job insecurity and bullying. Combined exposure to MSD and psychosocial risk factors has a more serious effect on workers' health than exposure to one single risk factor.

Complexity of new technologies and human–machine interfaces: the physical characteristics of workplaces, such as poor ergonomic of human–machine interfaces, augment workers' mental and strain and therefore the incidence of human errors and the risk of accidents. 'Intelligent' but complex human–machine interfaces are found in the air industry, in the healthcare sector (computer-aided surgery), in heavy trucks and earth moving machinery (e.g. in-cab joysticks) and in complex manufacturing activities (robots).

Multi-factorial risks: the experts especially highlighted multi-factorial risks. The literature focuses on call centres, which are multiplying and bring new types of jobs with multiple exposures: prolonged sitting, background noise, inadequate headsets, poor ergonomics, low job control, high time pressure, high mental and emotional demands. MSDs, varicose veins, nose and throat diseases, voice disorders, fatigue, stress and burnout are observed in call centre agents.

Insufficient protection of high-risk groups against long-standing ergonomic risks: this issue is recurrent through the forecast. Workers with low employment status and poor working conditions, who paradoxically are the subject of fewer training and awareness-raising measures, are identified as particularly at risk. An example is workers in the agriculture and construction sectors with poor knowledge of thermal risks related to work in cold or hot environments.

Thermal discomfort: lack of measures against thermal discomfort at industrial workplaces, where only thermal stress has been addressed so far, is highlighted. The impact of thermal comfort on workers' stress and well-being is considered as not adequately assessed. Thermal discomfort may impede workers' performance and safety behaviour, hence increasing the probability of occupational accidents.

General increase of exposure to ultraviolet radiation (UVR): the respondents strongly acknowledge ultraviolet radiation as an emerging risk. As UVR exposure is cumulative, the more workers are exposed during but also outside their working time, the more UVR sensitive they are at work. Hence a potentially growing need for prevention measures at the workplace.

Combined exposure to vibration, awkward postures and muscular work: Vibration, although considered a more 'traditional' risk, has gained more attention with the European Directive 2002/44/EC (EASHW 2005).

Electromagnetic pollution: After the invention of the first mobile phone in 1973, more and more people are using this convenient device in their everyday working routine (Saunders 2003). Recently the researches revealed that in some countries the usage of mobile phones is over 100 % of country's population. As more people are using their mobile gadget, the more EM polluted environment we have.

3.4. Psychosocial risks in work-life circle

The survey and the literature studies reveal that emerging psychosocial OSH risks are often the result of technical or organisational change. The top emerging psychosocial risks identified by the experts can be grouped into the following five areas.

New forms of employment contracts and job insecurity: the use of more precarious employment contracts, together with the trend towards lean production (producing good and services with less waste) and outsourcing (using outside organisations to carry out work), can affect workers' health and safety. Workers on precarious contracts tend to carry out the most hazardous jobs, work in poorer conditions and receive less OSH training. Working in unstable labour markets can give rise to feelings of job insecurity and increase work related stress.

The ageing workforce: one consequence of an ageing population and higher retirement ages is that Europe's workforce is older. The experts participated in the forecast say that ageing workers are more vulnerable to the

hazards resulting from poor working conditions than younger employees. The failure to provide ageing workers with lifelong learning opportunities also increases the mental and emotional demands made upon them. This may affect their health and increase the chance of work-related accidents. In order to promote healthy and safe work during a prolonged working life, good working conditions have to be provided and tailored to the needs of each, including ageing workers.

Work intensification: many workers are handling growing amounts of information, and having to cope with higher workloads and greater pressure at work. Some workers, particularly those employed in new forms of employment or highly competitive fields, tend to feel less secure. For example, these workers may fear having their efficiency and output assessed more closely, and hence tend to work longer hours finish tasks. Sometimes, they may not be compensated for the increased workload or receive the necessary social support to carry it out. A higher workload and more demands made on fewer workers can lead to an increase in work-related stress and affect workers' health and safety.

High emotional demands at work: this issue is not new, but it is of great concern, especially in the growing and increasingly competitive healthcare and service sectors. Bullying at work is identified by the experts as a contributing factor to the increased emotional demands being made on workers. The problem of violence and bullying can affect all occupations and sectors. For the victims and witnesses, violence and bullying result in stress may seriously affect both mental and physical health.

Poor work–life balance: problems at work can spill over into a person's private life. Uncertain casual work, high workloads and variable or unpredictable working hours, especially when there is no possibility for the employee to adjust them to their personal needs, can lead to a conflict between the demands of work and private life. The result is a poor work–life balance, which have a detrimental effect on a worker's well-being (EASHW 2005c; Bruhn and Frick 2010; Gilioli 2006).

Present occupational hazards at all workplaces are among initiators of many industrial accidents. The fatigue, loss of attention, stress cause by poor relations among employees and bad organisational culture may contribute to the occurring of the event known in the field of industrial safety as accident initiators. The two fields – occupational and industrial safety – overlap to a large margin. However, we can detect several industrial hazards outside the traditional field of occupational safety. They can be easily recognised as new and increasing ones.

4. Industrial hazards

4.1. Hazards of new technologies and aged plants

Industry has to deal with both new and ageing technology and their combinations. Emerging risks are connected to new technologies like developments of nanotechnology, biotechnology, and new chemicals as well as the increasing use of information and communication technologies. Many new innovations offer appealing solutions to industry, but too often all their properties and possible influences on other systems are not known.

Introducing more and more decentralised and combined plants, diversifying, e.g., energy production with renewable energy systems and similar measures lead to completely new issues: How to assess the risks of the unknown? Especially of long-term and complex impacts and effects. How to obtain data needed for reliability or risk assessments for the "one-of-the-kind" systems components and systems with virtually no operation record? These issues are still completely open, especially for industries which are traditionally less "risk-aware". The questions like, e.g., how to assess the risks of the unknown remain. Practices are to be developed, which include the hazard scenarios identification into the design and development of new products and technologies as well as a requirement and a procedure on the generation (laboratory testing, etc.) and collection of the data needed in the risk assessment of the new product or technology.

Speaking about ageing plants, industry is facing new challenges when the lifetime of the plant and its systems is prolonged well beyond its designed lifetime. Old plants are often economists' short-term favourites - economic pressure to increase the plant life can be huge and possible benefits (e.g., no need to ask for new permits, etc.) appealing. But the decisions can be made on unrealistic basis, when assessing risks of old plants is often done by younger engineers who do not have experience of the plant and who may lack reliable, even basic data. It is important to keep in mind, that in many cases the decision to build a new plant rather than "retrofitting" the old/existing may have dramatic (positive!) influence on the competitiveness and innovation in Europe.

Real integration of the life-cycle of the plant and the technology and assessment of medium and long-term risk is not necessarily the priority for the owner or for the inspector. Nevertheless, for the society, especially if combined with new technologies or refurbished plants it can be really a huge problem, in particular, when the one responsible for the risks/causes/consequences (e.g., a bankrupt company) is not accountable any more.

4.2. Hazards in networks and other interdependencies

Nowadays the industry has outsourced maintenance and other activities that are not considered as their core business. This way they have created complicated networks, where service providers have also outsourced their activities to subcontractors, which use other subcontractors and so on. Industrial sites are also split into several companies according to the different production activities and activities supporting production. This trend is creating industrial parks where several separate organisations are working on the same site and responsibilities are not always clear. How to ensure safety, security, and reliability of the networks and industrial parks is one of the key questions in the field (Zhang and Chen 2010).

Today industrial installations have several interdependencies with systems and installations that are not

under the same (safety) management. This has increased their vulnerability against secondary hazards when the primary source of hazard is one or several of their network partners. That creates situations in which all risks are not identified or identified risks cannot be affected by the identifier. For instance, large industrial areas involving chemical installations with substantial amounts of dangerous substances hold the risk of one accident triggering a chain of reactions of major incidents at neighbouring plants. These chains of hazardous events are called "domino effects". Domino effects can also be caused by other interdependent systems than neighbouring chemical installations.

The evaluation of these multi-risk scenarios requires multi-scientific approach and cooperation between experts from different fields of technology, social and economical sciences.

4.3. Hazards of nanotechnologies

Industrial needs for nanomaterials are increasing. Many sectors are concerned, ranging from mature high volume markets like automotive applications, high added value parts like space and aeronautic components or even emerging activities like new technologies for energy. Domains with a planetary impact like the environment and new products and functions for health and safety of people are also concerned.

Research on the potential applications of nanotechnology continues to expand rapidly worldwide. New nanotechnology consumer products emerge at a rate of three to four per week. Over the course of the next decade, nanotechnology could have a $1 trillion impact on the global economy and employ two million workers - half of them residing in the United States (NIOSH 2009).

Nanotechnologies will play a key role in promoting innovation in design and realisation of multifunctional materials for the future, either by improving usual products or creating new functions and new products. Nevertheless, this huge evolution of the industry of materials could only happen if the main technological and economic challenges are solved with reference to the societal acceptance. Technical issues related to nanosafety are:

Chemical reactivity of nanoparticles (in gas, solid and liquid phases, catalysis, fires);

- Explosivity (detonation) of nanoparticles;
- Initiating sources leading to reactivity and explosibility (i.e., thermal runaway, electrostatics, mechanical sparking, etc.);
- Life cycle risk analysis (from the creation to disposal of nanomaterials);
- Dispersion of nanoparticles in the air, water, soils;
- Toxicology and ecotoxicology (human, animal, vegetal);
- Epidemiology (possible spread of diseases caused by nanotechnologies).

Nanotechnology has the potential to dramatically improve the effectiveness of a number of existing consumer and industrial products and could have a substantial impact on the development of new products in all sectors, ranging from disease diagnosis and treatment to environmental remediation. Because of the broad range of possible nanotechnology applications, continued evaluation of the potential health risks associated with exposure to nanomaterials is essential to ensure their safe handling.

5. Proneness of Lithuanian industry to new and emerging hazards

Lithuania has a heritage of health and safety approach which is characterized by lack of attention to human's comfort needs and anthropometric issues in planning work places and public facilities. Not only occupational hazards but also industrial ones occur in Lithuania and can be called increasing and, in some cases, even very new.

5.1. Occupational hazards

The problem of waste management comparing to the problems of water management is a new phenomenon. Ecology and hazards are not simply phrases. Near Šiauliai toxic waste decomposition products broke through the small mould. Such dump, which are slowly contaminating ground water and air are located in all over Lithuania. Modern garbage is long-existing, slowly putrefying, but they poison environment constantly. Loads of garbage is not only environmental hazard but also menace for health of humans.

Dangerous wastes – toxic, flammable, explosive and other harmful substances which can cause damage to humans' or animals' health and environment. The biggest problem is artificial chemicals which are used in a daily life: voltaic cells, which contain heavy metals (Pb, Ni-Cd, Hg), accumulators, out-of-date medicines, liquid disinfectants, bleaches, waste of various clearings, polish, paint, waste of gumption, cosmetics, etc. The biggest part 50% of waste in Lithuania is compounds made of petroleum and water. What is more, a huge part of dangerous waste consists of mineral wool (9700 t) and solid contaminated by petroleum products (8500 t).

In Lithuania there were no dangerous waste management facilities as the first facility has been opened at the end of the last year in Šiauliai region. It is planned that 8000 t of dangerous waste will be burned in this facility (Ministry of Environment of the Republic of Lithuanian 2010).

Along increasing amounts of waste, the new issue occurred concern the electromagnetic pollution. As mobile phones became a common device in working and leisure environment, the electromagnetic radiation has also increased. Antennas of base stations are constructed on towers, roofs of high buildings or water towers. While using a mobile phone just a very small amount of radiation fall to an antenna. All the rest radiation is spread in the environment, so a mobile phone has to radiate high-powered signal. As more often and longer people are

talking using mobile phones, the more polluted is the environment. The hazards on humans‘ health of EMF base stations are discussed in all over the world (Cardis 2010) and Lithuania as well.

Ergonomical issues and MSDs became highlighted in Lithuania very recently – starting in 2006 (Jokantaitė 2009). According to statistics of the Lithuanian Institute of Hygiene, ergonomicl hazards related to MSDs are rapidly increasing from 12% in 2000 to 51% in 2008 of all occupational diseases. K. A. Kaminskas (2007) submitted system model of ergonomical risk factors assessment helps to draw a boundary between ergonomical risk factors assessment by applying approximate and concrete methods, which allows to increase the quality of MSDs assessment.

Apart from the ergonomical problems, a new area in Lithuania is assessment of psychosocial risk factors. Psychosocial risk factors are quite hard to identify and analyze, as this work needs special knowledge and experience (Pajarskienė and Jankauskas 1998). Psychosocial hazards can be specified as “new” in term that new scientific knowledge allows a long-standing issue to be identified as a new hazard (e.g., in the situations where cases have existed for many years without being identified as hazard because of lack of scientific knowledge). This field of hazards just recently became spotted in Lithuania. Although the legislations concerning this issue was approved in 2003, but still not many companies are interested in their employees’ social environment and mental health.

5.2. Industrial hazards

Lithuania is increasingly involved in the global economic process and consequently exposed to new and increasing industrial hazards. At present, Lithuanian economy is not among ones with highly sophisticated technologies and new industrial risks. However, some facts of exposure to such risks can be mentioned here.

In the 1990s, Lithuania inherited old soviet industrial infrastructure which in the last two decades was subjected to an intensive aging. A number of accidents caused by material aging were reported in Lithuania. An example of such accident was a failure of Neris bridge in Kaunas in 2009. The failure was caused by overloading and corrosion damage to movement hinge. A further example was an accident which happened as a rupture of a gas pipeline in Širvintos district. This accident occurred in marsh area. There gas pipe blew out due to corrosion.

Lithuania has serious problems with independence and diversification in its energy sector. Renewable energy sources are considered to be a vital alternative to the supply of energy from one producer. Wind energy is viewed as a potential supply source. However, the environmental impact of wind power-plants is not always completely positive. Wind turbines induce infrasound. In addition, wind power facilities have negative impact on wildlife. The birds strike against rotors and lose lives sometimes. The wind power-plants scare moles. In some cases a construction of wind turbines provokes erosion of soil. The wings of the turbines can cast shadows. They begin shimmer with the frequency of wings turning. This effect comes into play in buildings which stand in vicinity of the turbines (Nikitenka 2007).

In the recent decade, a number of industrial parks were established in Lithuania. They are located in Šiauliai, Kėdainiai, Panevėžys, Alytus, Marijampolė, Naujoji Akmenė, Radviliškis, Pagėgiai. In each of them, several separate organisations are working on the same site and responsibilities in terms of safety are not always clear. Unfortunately, the assurance of safety and reliability in Lithuanian industrial parks still remains a problem. In addition, industrial parks have a negative impact on the environment is (Paliokaitė *et. al.* 2007):

- vanishing species and loss of wildlife;
- erosion of soil;
- risk to water resources and air pollution;
- noise, vibration, increasing traffic.

The last of the industrial hazards mentioned in Sec. 4 are nanotechnologies. To this day, the Lithuanian industry of nanotechologies is only in the early stage of development. Nanohazards can be posed in our country only by imported products. „Baltic nanotechnologies” company is the first distributor of nanoproducts in Lithuania. It trades non-combustible protective nanocoatings. Nanotechnologies are researched intensively in Lithuanian universities and institutes. It is likely that these technologies will reach Lithuanian industry and the end-user in future. Like many innovative technologies, nanotechnologies have their pros and cons. Development of nanotechnologies and introduction of nanoproducts into market are very rapid and do not take into accounts thoroughly possible risks. Characteristics of some nanoparticles are similar to ones of asbestos. Many nanoparticles can be toxic to human tissues and cells. They can cause stress, DNA mutations and loss of cells. These particles can penetrate through cell walls and organ tissues (Belousovaitė 2010; Petersen *et al.* 2007; Bello and Isaacs 2010).

6. Conclusion

The problem of rise and growth of occupational and industrial hazards has been considered. This problem becomes more and more topical in many branches of European industry as well as in Lithuanian. The main findings are:

1. Hazards are highly diverse and require immediate action in order to avoid an increase of occupational and industrial accidents. The management of the risk posed by some of the hazards requires extensive and expensive actions. This particularly applies to the hazards which can trigger off major industrial accidents.
2. Hazards existing in some occupational environments pose smaller risks and endanger only small number of working individuals. However, these hazards need to be dealt with by means of risk analysis which is carried out for individual workplaces and occupations. Unfortunately, procedures of such an analysis are still under development. Awareness of new hazards increases

among general public and individual professions. However, some hazards need to be investigated in greater depth to find safety measures allowing to reduce or eliminate them. Examples of such hazards are the ones posed by nanotechnologies and nanoproducts.

3. Lithuania, the country of authors' of this work, is exposed to the new and increasing hazards to more or less the same degree as other European countries. Lithuanian economy is not among ones with highly sophisticated technologies and new industrial risks. Although our industry is not developed as industries of Western European countries, the new and increasing hazards are present in the waste treatment. Increasing psychosocial and ergonomic problems are observed in most of industry branches. The electromagnetic pollution of living and working environment in Lithuanian are steadily.
4. The new industrial hazards can also be found in the young and developing Lithuanian economy. The hazards post by technologies of renewable energy and nanotechnologies can serve as an example. A further example is hazards which come into place with rapid development of industrial parks in Lithuanian. Although aging of industrial equipment facilities and infrastructure is common in the entire Europe, hazards post by the process of aging are highly specific to Lithuanian. Apart of it's industrial assets stamp from the soviet time and has experience at very high degree of aging.

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