BULETINUL INSTITUTULUI POLITEHNIC DIN IAŞI

Tomul LIX (LXIII)

Fasc. 3

ŞTIINȚA ŞI INGINERIA MATERIALELOR

2013 **Editura POLITEHNIUM**

BULETINUL INSTITUTULUI POLITEHNIC DIN IAŞI
PUBLISHED BY
„GHEORGHE ASACHI" TECHNICAL UNIVERSITY OF IAŞI
Editorial Office: Bd. D. Mangeron 63, 700050, Iaşi, ROMANIA
Tel. 40-232-278683; Fax: 40-232 237666; e-mail: polytech@mail.tuiasi.ro

Editorial Board

Editorial Advisory Board

BULETINUL INSTITUTULUI POLITEHNIC DIN IAŞI
BULLETIN OF THE POLYTECHNIC INSTITUTE OF IAŞI
Tomul LIX (LXIII), Fasc. 3 2013

ŞTIINȚA ŞI INGINERIA MATERIALELOR

SUMAR

BULETINUL INSTITUTULUI POLITEHNIC DIN IAŞI
BULLETIN OF THE POLYTECHNIC INSTITUTE OF IAŞI
Tomul LIX (LXIII), Fasc. 3 2013

MATERIALS SCIENCE AND ENGINEERING

CONTENTS

BULETINUL INSTITUTULUI POLITEHNIC DIN IAŞI
Publicat de
Universitatea Tehnică „Gheorghe Asachi” din Iaşi
Tomul LIX (LXIII), Fasc. 3, 2013
Secția
ŞTIINȚA ŞI INGINERIA MATERIALELOR

TENDENCIES AND INFLUENCES OF THE SUSTAINABLE DEVELOPMENT REGARDING THE OCCUPATIONAL SAFETY AND HEALTH

BY

PETRICĂ CORĂBIERU[1,*] and ANIŞOARA CORĂBIERU[2]

[1] SC PROCOMIMPEX SRL Iaşi,
[2]“Gheorghe Asachi” Technical University of Iaşi
Faculty of Material Science and Engineering

Received: February 28, 2013
Accepted for publication: March 7, 2013

Abstract: The innovation strategy of the products is a component of the sustainable development of the enterprises. The creative solving of the problems, including those related to the occupational safety and health, interfere in defining the objectives of the enterprise for the sustainable development, namely the production and products which comply with the principles of zero-loss and zero-emission. The paper highlights the tendencies and influences determined by the necessity for the sustainable development of the enterprise regarding the aspects related to the occupational safety and health. The creative solving of the problems related to the occupational safety and health has to become stimulating factors of creativity and not barriers which lead to blockages of the creative processes.

Keywords: sustainable development; occupational safety.

1. Introduction

Creative settlement of the problems supposes the utilization of innovative techniques based on the following aspects:

[*]Corresponding author: *e-mail*: pcorabieru@yahoo.com

a) transparent climate;
b) management adequate style;
c) motivation systems favorable to change;
d) adequate organizational culture;
e) resources and competences.

Creative settlement of problems is achieved by teams that deal with creative functions of explorer, artist, judge and fighter. These parts have to be built and ensured by the organization management for the achievement of innovative processes. Managers will be this way placed in organizational system based on a new philosophy and producing actions of creative type, by normal evolution towards structures of net type, auto-adjustable and auto-governable (Farina & Preissl, 2000).

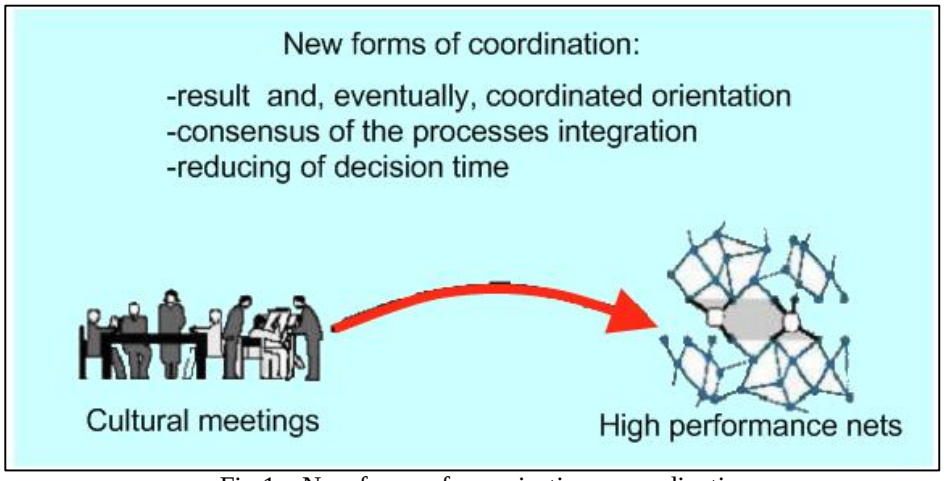


Fig.1 – New forms of organization – coordination.

The development of the progressive aptitudes is of real help within the organizations, in the view of increasing their capacity to produce the new combined with the useful, to stimulate the organizational and individual creativity in finding innovative solutions for the complex problems (Guran, (2008).

2. Foundations of Approaching and Evaluating tThe Problems of Occupational Safety and Health in the Context of the Sustainable Development

The creative problems settlement, including health and safety, can be approached as an adapted, systemic and structured model of contradictions settlement, built on formal-abstract bases and which permits the transcription of the specific problem in a general context, while its instruments offers the

possibility of finding and implementation of a general solution, at its turn transposable to the specific problem (Arai & Shimomura, 2004; Gurteen, 1998).

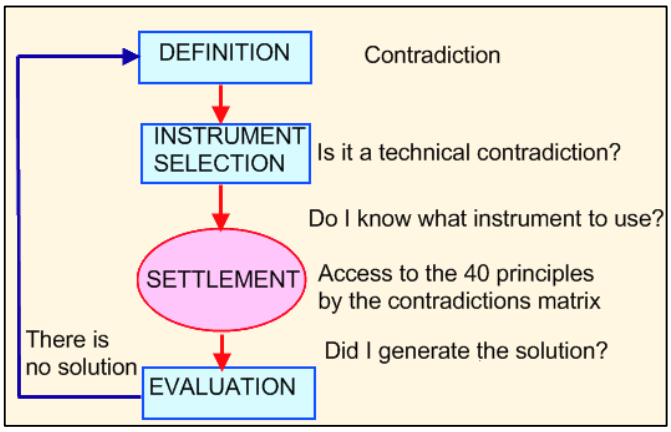


Fig. 2 – Steps of problems systematic settlement.

The most utilized general instrument for the systematic settlement of technical and health and safety, problems is represented by the contradictions matrix. This matrix, by construction, orientates the user toward the most utilized innovation principles for each identified contradiction.

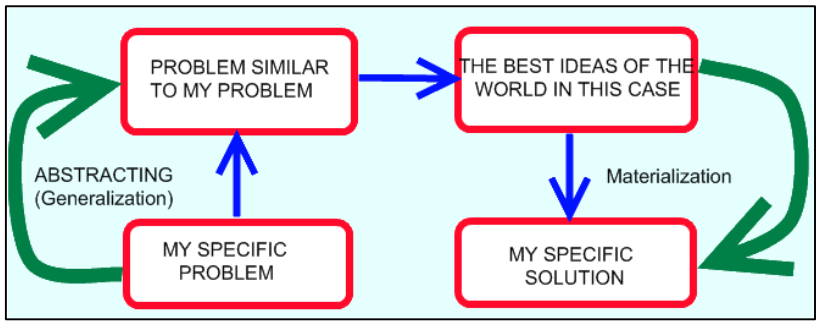


Fig. 3 – Method of problems settlement.

In the context of the awareness regarding the permanent necessity of innovating and intensifying the efforts in the sense of creating new products, the approach of evaluating the problems of occupational safety and health is included in the European method of approaching the innovation as a complex and integrating process of solving the problems.

3. The Implications of the Products Development in the Context of Sustainable Development

At international level, considering normally the list of the most important enterprises and corporations, it is had in view to harmonize the points of view of the producer and user regarding the products life cycle (Munteanu, 2006). The research of the Fraunhofer Institute identifies the product development as the main paradigm for the next ten years. Three main directions in what concerns the product development have been identified: increase of competitive solutions number, shorting/hurrying the iterative ringlets and self-control organization. From an organizational point of view, a change without precedent is proposed for the organizational structures: passage from a stiffly controlled, hierarchical structure to a self-adjustable and self-governable net structure.

In Germany, by The Digital Auto Project program, the diminishing with 50% of the product development time is proposed. The project is based on three working principles: increase of the simultaneity of the designing charges; elimination of certain designing charges, as the physical prototype; more rapid completion of the remaining project (Kimura, 2000).

In the USA, at the basis of the product development stands the idea that only by the way of choice shortening the designing, building and manufacture processes can be fundamentally changed. Simultaneity designing/study leaded to the reduction of the personnel with 25% and implicitly, to the costs diminution (Moraru, 2008).

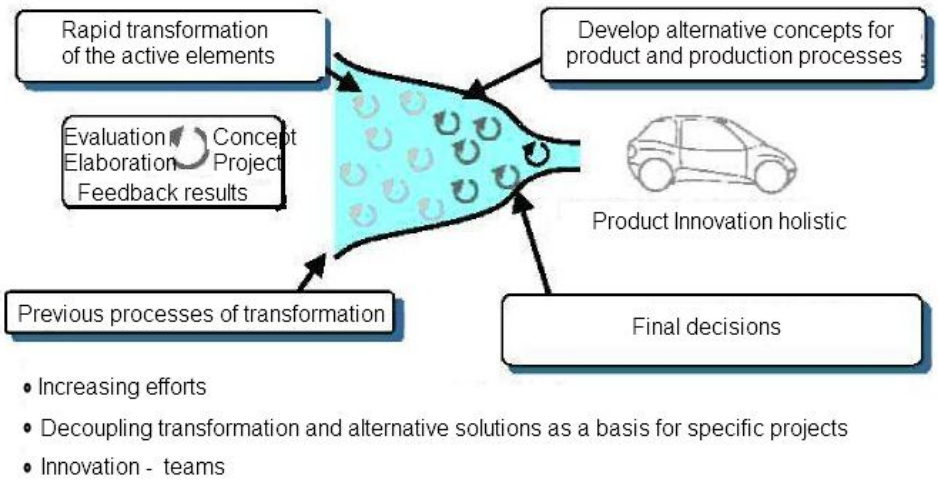


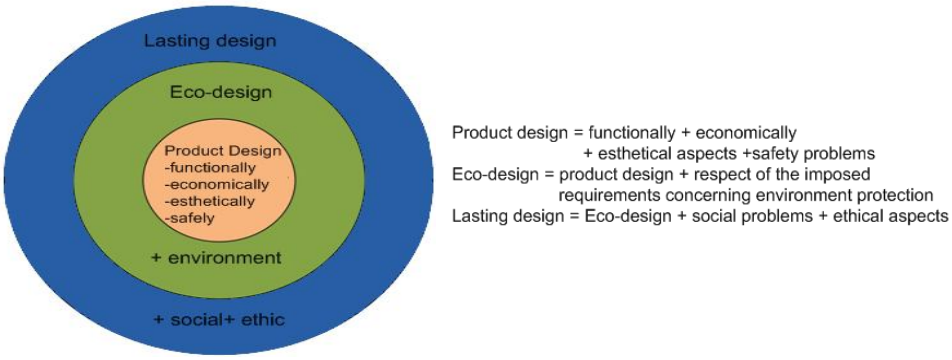
Fig. 4 – Development of iterative development worldwide.

In France, the accent is put on the methods that lead to the best solutions of materials for the new products, so that a recycling ratio of 95% could be provided, by choosing plastic materials. At the whole world level, the tendency is to utilize the multidiscipline design optimizing, a design technique of the complex systems and of sub-systems exploiting the synergy of mutual interaction of the phenomenon. The methodology offers the possibility of answering the questions: how to decide what to change? What change is amplified when the system is interactive (each of them influences each of them)?

All these are possible due to the possibility of achievement of a very big number of iterations in a very short time, many solutions succeeding to be studied at a relatively low cost, by the implication in the evaluation of all the points of view of the relevant performance attributes (Zait *et al*., 2008).

4. Current Trends at European level

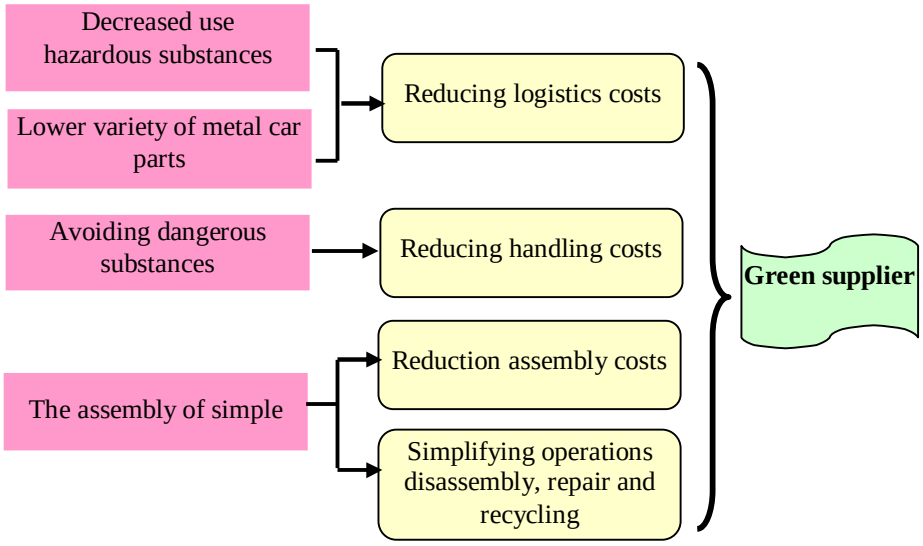
1. Ecodesign



2. Green supplier:

a) the green auto products are in many cases more efficient than the other products → the tendency in Europe is that the green sells better;

b) in the European auto industry 20%…40% of the production costs are represented by the consumption of materials and energy → the minimization of the material expenses per unit of product reduces the costs and makes the product greener.



The argument of being a green supplier → the argument of being chosen as supplier of metallic auto components and parts.

3. Product environmental profile

1	Identifying the environmental impacts that are generated by the metallic auto parts
2	Determining the critical stages of the life cycle for a given impact
3	Identifying the improvement margins
4	Evaluating the advantages and disadvantages represented by the improvement ways.
5	Replacing the quality steel with normal steel for the metallic auto parts, with design modifications which insure them a resistance as good as that of the previous materials

4. The system of authorized ecological management

a) Eliminating the components with a high risk in order not to contaminate the waste coming from the dismantled vehicles.

b) Implementing the systems of authorized ecological management in the units which perform treatment operations (Zboon, 2009).

c) Obligating the units which perform treatment operations to have a permit issued by the competent authorities.

d) The competent authorities should periodically check the type and quantity of waste which follows to be treated, complying with the minimal technical requirements for treatment, complying with the safety measures.

5. Principle of total quality

a) Periodically certifying the personnel.

b) Accrediting the analysis laboratories.

c) The technical level accepted for the treatment installations.

d) Hhigh standards for: decontamination, storage, collecting, recovery, reuse and recycling.

6. Recycling throughout the product life

Taking into consideration the following aspects during the design stage:

a) recycling during the stage of product development (evaluation system before the recovery, the plan takes into consideration the recycling and the plan which focuses on the impact upon the environment);

b) recycling during the stage of product manufacturing (technologies for recycling the resins, the rubber, using the variety of recycled materials);

c) recycling during the stage of exploiting the metallic parts (recycling the waste given by the dealers and reconditioned parts);

d) recycling during the stage of dismantling (a practical instrument for dismantling, factory specialized in the domain of recycling dismantled vehicles, effectively using the waste coming from dismantled vehicles, intensifying the researches in the recycling domain).

5.Conclusions

Lasting development offers a changed perspective on the product as the product development is considered starting by the consideration of environment aspects. Product environment study grants a better understanding of the composition and function of the product component parts, as well as of the relations on the entire flow of supplying with raw materials. An adequate management of this flow represents a premise for a superior quality of the entire product.

The sustainable development takes into consideration all the products, because they all require raw material and energy for the manufacturing process, energy for transportation and packing, and at a given moment they will all become waste, even if up until then some of them benefited by a new life through reuse and recycling. As a consequence, all the enterprises can act directly or indirectly on the improvement of the products development, involving in the chain of products development and eco-design the manufacturing entity, the intermediary that commercializes the product, the participant to defining the tender book and the subcontractors.

Improvement of the product development will be achieved by the enlargement of changing possibilities in the initial phases as the costs of

defects repair or elimination increase exponentially with each step of the product development cycle.

The problems of occupational safety and health are solved during the stage of product design (safety problems), being included in the tendency of widening the change possibilities since the initial stages.

Yet in the product conception phase it is taken into consideration that the recycling takes place on whole product lifecycle enlarging this way the possibilities of improvement of the study and consistence way of the lifecycle and permitting the re-design of the products in the vision imposed by the lasting development concept.

REFERENCES

Arai T., Shimomura Y., *Proposal of Service CAD System – A Tool for Service Engineering.* Annals of the CIRP, **53**, *1*, 397-400 (2004).

Gurteen D., *Creativity and Innovation*. J. of Knowledge Management, **2**, *1* (1998).

Farina C., Preissl B., *Research and Technology Organisations in National Systems of Innovation*. DIW Berlin, 2000.

Guran M., *Knowledge Management Using Intranets and Enterprise Portals.* Internat. J. of Comput., Commun. & Control, **3**, 75-81 (2008).

Kamel Al.Z., *Trend in Exhaust Emissions from In-Use Gasoline Vehicles.* Environ. Engng. a. Manag. J., **8**, *1*, 11-16 (2009).

Kimura F., *A Methodology for Design and Management of Product Life Cycle Adapted to Product Usage Modes*. Proc. of the 33th CIRP Internat. Seminar on Manufact. Syst., KTH, Stockholm, Sweden, 2000, 139-142

Moraru G.M., *Creativity in Knowledge Based Organizations.* Proc. of the 17 th Internat. Conf. on Manufact. Syst. (ICMaS), Published by Edit. Academiei Romane, Bucureşti, 2008, 411-414.

Munteanu D., Munteanu I., Cofaru C., *Efficient Management Methods for Increasing Productivity and Quality*. The 7 th Internat. Conf. of Technol. a. Quality for Sustained Develop., May 25-27, Bucharest, România, organized by Univ. Politehnica of Bucharest in cooperation with Politecnica di Milano, Italy and De Montfort University United Kingdom, Proccedings TQSD06, 2006, 609-615, AGIR Publishing House.

Zait D., Velicu S., Corabieru P., Corabieru A., Vasilescu D.D., *Tendences and Solutions Regarding the Development of the Metallic Products for Auto-Vehicles.* Metalurgia Internat., **XIII**, *12*, Bucureşti, 76-81 (2008).

TENDINȚE ŞI INFLUENȚE ALE DEZVOLTĂRII DURABILE ASUPRA SECURITĂȚII ŞI SĂNĂTĂȚII MUNCII

(Rezumat)

Strategia de inovare a produselor este o componentă a strategiei de dezvoltare durabilă a întreprinderilor. Rezolvarea creativă a problemelor, inclusiv cele legate de

securitatea şi sănătatea muncii, intervin în definirea obiectivelor întreprinderii pentru dezvoltarea durabilă, adică producție şi produse care respectă principiile zero-pierderi şi zero-emisii poluante. Lucrarea evidențiază tendințele şi influențele determinate de necesitatea dezvoltării durabile a întreprinderii asupra aspectelor legate de securitatea şi sănătatea muncii. Rezolvarea creativă a problemelor legate de securitatea şi sănătatea muncii trebuie să devină factori stimulatori ai creativității şi nu bariere care conduc la blocaje ale proceselor creative.

BULETINUL INSTITUTULUI POLITEHNIC DIN IAŞI
Publicat de
Universitatea Tehnică „Gheorghe Asachi” din Iaşi
Tomul LIX (LXIII), Fasc. 3, 2013
Secţia
ŞTIINŢA ŞI INGINERIA MATERIALELOR

PSYCHOSOCIOLOGICAL ANALYSIS OF RISK BEHAVIORS OF WORKERS IN WORK

BY

CIPRIAN VREME*, ANGELICA DRĂGHICI, EMILIAN GHICIOI, SORIN SIMION and MARIUS KOVACS

INCD INSEMEX, Petroşani

Received: June 28, 2013
Accepted for publication: July 17, 2013

Abstract: The work process requires that the following components: work equipment, work environment, the task and the human factor represented by the worker.

Dangerous acts produced by the human factor in conjunction with hazardous conditions (created by work equipment and working environment) leads to producers of events or accidents.

Dangerous acts of worker are due to risk behaviors that he manifested in the work.

The analysis often events / accidents involves only technical components emphasizing the working process, the human factor is neglected. However the latter is the most dynamic element of the work process.

Statistics show that the production worker is the main cause of accidents at work in over 80% of cases.

In this paper we analyze in terms of worker psycho risk behaviors during work activities.

Keywords: risk behavior; accident.

The work requires the following components: work equipment, work environment, work load and human factors represented by the worker.

*Corresponding author: *e-mail*: insemex@insemex.ro

During labour activity the worker is subject to both physical demands and psycho nerve requests. Specific to these applications is that they are dependent manner and work together always occurs while taking into account the quantitative aspect of the total request from their sum.

They may differ depending on the type of work that is performed in a given time. Physical demands and concerns in particular of the skeletal muscles, internal organs, especially circulatory and digestive systems.

Psycho nerve requests relate to human organs and nerve function and outwardly as irritants process knowledge and will.

Causal links between the two basic types of applications that are characterized by abnormal requests, for example in psycho nerve not only reduces mental capacity and physical as it is associated with.

Separation of the two types of applications can be only theoretical aspect. The two types of queries are produced directly in the work, and under the influence of average (as understood in the widest sense of the lighting, chemically and physically environment, , to the relations between people).

For the normal work requests there must fulfil certain conditions, worker and work environment.

Worker must meet both of the following conditions relating to: skills, knowledge and experience required in the job; average work capacity; be healthy and mentally balanced; have positive representations of work; be properly motivated.

Regarding this work must be continued for a long period of time after exercise do not leave a negative influence, contain the possibility of job satisfaction and personality development opportunity.

Overuse occurs when the worker don’t has knowledge, ability and experience and therefore must make a greater effort to accomplish a task. This discrepancy between the demands of work and opportunities to accomplish it generally leads to a mental strain, but otherwise, when man has more knowledge and experience than capacity and calls his work will have satisfaction. In both cases we deal with the negative effects of occupational stress.

If the over impact load or under impact load is occurred, we can say that we are dealing with distress that can lead to risky behaviours, and they generate dangerous acts.

Dangerous acts together with the existence of a dangerous situation creates the potential occurrence of an event or an accident at work.

In addition to worker qualities and aspects of another factor causing stress is the human relationships within the organization, whether it is the structured horizontally or vertically.

The first category includes relations that occur between partners of the same level, and the second includes the relationships between people with decision function and performers.

Cohesion, cooperation, team spirit, sense of belonging and respect for principles such as complementarily, interdisciplinary, debate, confrontation reached without insults and personal attacks between members of a group is usually the recipe for performance.

Otherwise reaching tensions, misunderstandings, aggressive tone, conflicts and so on, and as such appear: aversion to work, insecurity, anxiety, depression or other phenomena that reflect negatively on the individual, family or social micro in which it belongs. These are elements of the stress created by the human factor.

Negative effects may also have strained relations vertically through: labour provisions imprecise; unjust attitude towards subordinates; unfulfilled promises; negative personal example of the manager; unfair distribution of rewards and sanctions.

Most often the events analysis, involves accidents only the process components highlighting technical aspects of work, the human factor is neglected. However the latter is the most dynamic element of the work process. Statistics show that over 80% of cases of work accidents is the human factor. Moreover statistics show that 10% of workers are responsible for 50% of accidents suffered (Bogaty, 2004).

Psycho-sociology labour issues concern the way in which man can be adapted working conditions and achieve performance at its level of development. Also an important aspect of the problem is to achieve safe work and health of the workers in order to prevent the occurrence of diseases and accidents at work.

Accidents etiology is complex, represented by objective and subjective factors. Material factors related to equipment, work-, environmental conditions or insufficient security measures and occupational health, human factors are represented by adapting incomplete or adapt the work.

Of them have an important role: attention, memory, intelligence poor (especially multiple injured); characteristics of individual emotional (irritability, emotionalism); imprudence, carelessness, indifference, neglect; disturbances skills, interests, aptitudes; lack of experience; physical fatigue overwork; family problems; habit to perform tasks without complying with safety standards and occupational health and sustaining this behaviour.

More accurate knowledge of the potential worker to perform optimally and efficiently in studying the mechanisms of adaptation to stress, coping processes workers aims to prevent fatigue, illness and accidents at work.

Efficient conduct of an activity implies a complex skill that they meet the requirements of that activity for avoiding negative consequences (adjustment disorder with negative effects on the individual, social relations and

the occupational safety) only objective knowledge of all individual traits and professional applications and reach agreement between them can resolve the problem.

Achieving this agreement intended to lead to integration in the professional worker can work by targeting and selection.

Orientation is guiding the person to a profession or group of professions and skills in accordance with its options.

Selection is choosing among several candidates of the best for a particular profession or rejection of the unfit.

Both selection and orientation have four important areas: selection of employment; selection of candidates for different types of education; selection for specific functions; selection for specific jobs.

In support of this problem comes applied research that provides scientific methods to assess the human potential for employment and / or maintenance personnel in post especially collective responsibility on line safety at work and the development of optimal behaviour in extreme situations (interventions for liquidation damages, actions in case of accidents and so on).

Essential in professional selection is to establish the degree of correlation between individual characteristics and qualities necessary for the successful completion of a particular activity. Mental qualities is diagnosed with a scientific method that requires continuous review and improvement.

Psychological evaluation has mainly two important goals - one with diagnostic role (establishing existing mental capacities and level of development) and another part-time forecasting regarding resistance to psychic factors, possible developments (due to practicing and adaptation) or any involutions that can predict.

Also an important role in the integration of the worker in the work it takes to find a corresponding collective, it must be able to operate.

Internationally there is a conjunction between technical and psychosocial aspects.

For example, in European security culture formation is achieved by promoting it in the so-called "security seminars".

It is about using techniques of group formation, in which the transmission of an exclusive relationship animation collective action does not exclude involvement. Safety training also constitutes a real benefit in shaping the practice of cooperative activities, thus contributing to the promotion of open attitude on the nature of work, team spirit, self-help, sense of duty and responsibility towards the material goods and especially to the human person.

In Fig. 1. presents the number of accidents is nationally distributed by counties, as shown in the report of the Ministry of Labour (www.mmuncii.ro/...).

As can be seen from ITM Bucharest recorded most cases of injured workers (653). There is also a higher proportion of injured workers over 100 cases registered in ITM Brasov, ITM Timis, ITM Petrosani, ITM Arges. At the

opposite pole is ITM Caras Severin, ITM Giurgiu, ITM Vaslui, ITM Ialomita, ITM Vrancea, ITM Covasna, with more than 20 injured.

The literature shows that psychological factors are judged to be the basis of personal risk profile of a person to injury we find:

a) reaction speed greater than the speed of perception;

b) strong maladaptive emotion - moments of panic and fear that some employees may experience unexpected or stressful situations;

c) family or financial problems affecting the ability to focus attention;

d) attention disorders and hyperkinetic;

e) fatigue;

f) an attitude of neglect or defamation inadequate means of protection;

g) excessive confidence in their own possibilities leading to high risk taking;

h) impatience and impulsiveness specific to youngest people (Bogaty, 2004).

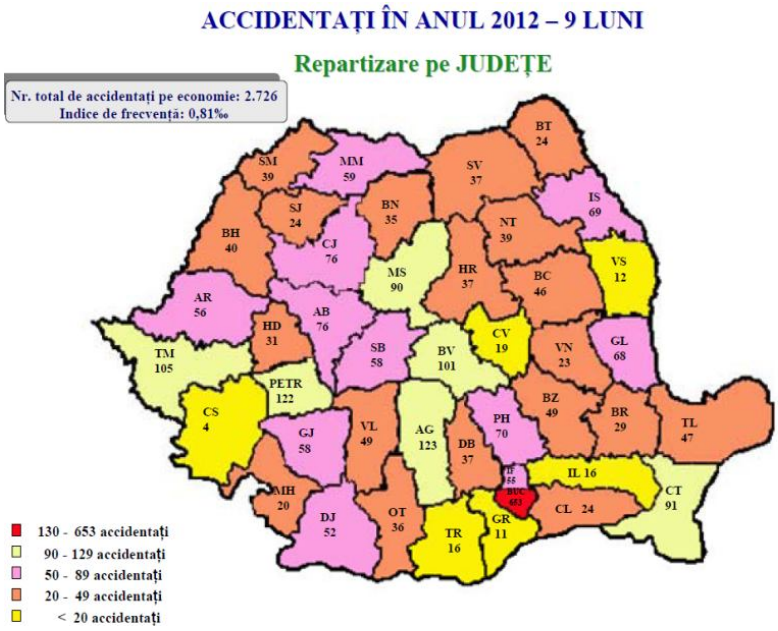


Fig. 1 – Statistics national occupational accidents (www.mmuncii.ro/nou/images/buletin_statistic...).

In Fig. 2 we can see that employees with less than five years old are injured at a rate of approximately 44%, which can be explained by the fact that they were unable to form the necessary skills to successfully perform the work.

Also a high percentage of injured workers, about 25% can be identified and among workers with great experience (over 20 years of experience in the

profession). This I can explain the fact that routines and high risk-taking caused by excessive confidence in their potential combined with a reduced risk perception of the profession is an important factor in work accidents.

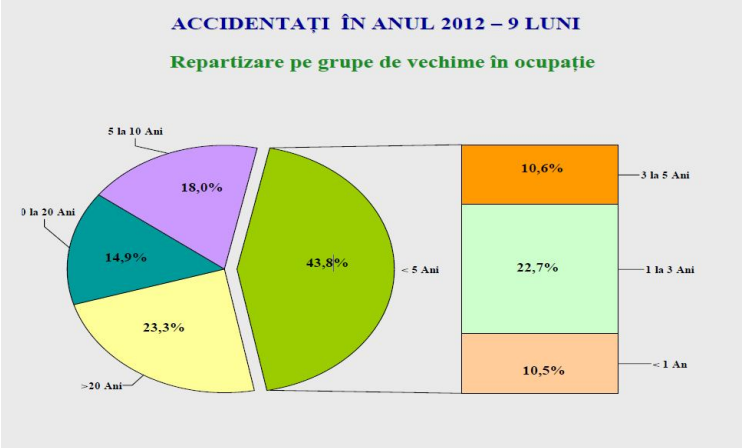


Fig. 2 – Accident situation based on seniority in the profession (www.mmuncii.ro/nou/images/buletin_statistic...).

Conclusion

We emphasize that the human factor is the most important part of the work process, since it is he who gives the dynamism. We want to draw attention to the need to pay special attention to trends in risk behavior of workers so that they can not be transformed into risky behaviors.

Psychological selection of workers should be carried out rigorously and continued with training programs should contain and suppress elements of risk. Awareness, in our opinion, is the first step in tackling risk behaviors of workers in the workplace.

Prevention can be achieved in regular employment trainings, special attention should be given to groups of employees with less seniority in the profession (under 5 years) and those with greater experience (over 20 years of experience in the profession).

REFERENCES

Bogaty Z., *Manual de psihologia muncii şi organizaţională*. Edit. Polirom, Iaşi, 2004.

Botez C., Mamali M., Pufan P., *Selecţia şi orietarea profesională*. Centrul de Documentare al Ministerului Muncii, 1971.

Pitariu H., *Psihologia selecţiei şi formării profesionale*. Edit. Dacia, Cluj-Napoca, 1983.

* * * http://osha.europa.eu/fop/romania/ro/statistics/accidentul_de_munca.shtml

* * * www.mmuncii.ro/nou/images/buletin_statistic/conditii_de_munca__trim._III_2012.

ANALIZA PSIHOSOCIOLOGICĂ A COMPORTAMENTULUI DE RISC AL LUCRĂTORULUI ÎN PROCESUL DE MUNCĂ

(Rezumat)

Procesul de muncă presupune existența următoarelor elemente componente: echipamentele de muncă, mediul muncii, sarcina de muncă şi factorul uman reprezentat de către lucrător.

Actele periculoase produse de către factorul uman coroborate cu condițiile periculoase (create de echipamentele de muncă şi mediul de muncă) duc la producarea unor evenimente sau chiar accidente de muncă.

Actele periculoase ale lucrătorului apar datorită comportamentelor de risc pe care acesta le manifestă în procesul de muncă.

De cele mai multe ori analiza evenimentelor/accidentelor de muncă presupune doar evidențierea aspectelor tehnice ale componentelor procesului de muncă, factorul uman fiind neglijat. Totuşi acesta din urmă reprezintă elementul cel mai dinamic al procesului de muncă. Statisticile arată că lucrătorul este principala cauză în producerea accidentele de muncă în peste 80% din cazuri.

Se analizează din punct de vedere psihosociologic comportamentele de risc ale lucrătorului în timpul activității de muncă.

BULETINUL INSTITUTULUI POLITEHNIC DIN IAŞI
Publicat de
Universitatea Tehnică „Gheorghe Asachi” din Iaşi
Tomul LIX (LXIII), Fasc. 3, 2013
Secţia
ŞTIINŢA ŞI INGINERIA MATERIALELOR

PREACCIDENT EVALUATION OF THE PROFFESIONAL RISKS ASSOCIATED TO THE DISABILITIES PERSONS

BY

DORIN LUCA*, CONSTANTIN BACIU and EMILIAN BICIUŞCĂ

“Gheorghe Asachi” Technical University of Iaşi
Faculty of Material Science and Engineering

Received: May 05, 2013
Accepted for publication: May 17, 2013

Abstract: This paper presents a study concerning the problems, the rights and the obligations of persons with disabilities. At employing it is mandatory to be performed instruction on the security line and health at work for each employee. The persons that are suffering of disabilities (handicap) represent a special category of employees, which is making part from sensitive to risks groups category. This makes that the attention that must be granted to the persons with disabilities fit at work to be increased, including at the evaluation of risks at accident and professional diseases. Protection of rights and dignity of persons with disabilities it is assured by the Convention regarding the rights of the persons with disabilities, adopted by ONU at December 13, 2006. At its turn, Romania has legislated the National Strategy for protection, integration and social inclusion of persons with handicap during 2006-2013. The paper presents at the end a case of integration and social inclusion of three persons with disabilities, which were employed on the posts: assistant manager, guard and unqualified worker.

Keywords: persons with disabilities; professional risks; risks evaluation; social integration.

*Corresponding author: *e-mail*: dluca@tuiasi.ro

1. Introduction

Once with adoption of decision United Nations Organizations no. 56/168 from December 19, 2001, it had been opened the path for adopting an international convention comprehensive and integrative, of promotion and protection of the rights and dignity of the people with disabilities (handicap).

After almost five years of efforts made by the Ad-hoc Committee established, by governmental organizations and non-governmental and by national institutions for people's rights, the Convention considering the rights of people with disabilities has been adopted at New York by the General Assembly of the United Nations Organizations at December 13, 2006 and it has been open for signatures at March 30, 2007.

The Convention has as purpose the guarantee of exercise of the rights for the persons with disabilities in conditions of equality with all the rest of the citizens.

European Union (EU) signed the Convention regarding the rights of people with disabilities at March 30, 2007. Since then, the convention has been signed by all 27 member states EU and by other 120 states from the world. After closing the process of ratification, EU as entity is now the first international organization which had become official part at convention. As well, European Union became for the first time in his history part of a pact considering the rights of people.

The convention obligates the parts (countries) to make sure that the disabilities people can exercise their rights completely, in conditions of equality with all the other citizens. For EU, this thing means to make sure that the entire legislation, politics and Community programs are accordingly with the provisions of Convention regarding the rights of people with disabilities, in the limit of competences EU. The states that had approved the convention must take actions in the following fields: access to education, occupy of the workforce, transport, infrastructures and buildings opened to the public access, according the right for vote, enhancing the political participation and assurance of the complete juridical capacity of all persons with disabilities.

The parts that had approved the convention will have to inform periodical the Committee ONU for the rights of persons with disabilities concerning the actions taken in order for applying it. The Committee, composed from independent experts will emphasize deficiencies for applying the convention and to formulate recommendations.

The Article 27-*Work and the right to work*, from Convention, stipulates that the States Parties recognize the right of people with disabilities of working in equality conditions with the others, including for those who acquire a disability during employment, they will protect and promote the right to work by taking adequate actions and they are obligating to:

a) to prohibit discrimination on criteria of disability referring to all aspects and the forms for work fitting;

b) to protect the rights of people with disabilities, in conditions of equality with the others, from the point of view of all the right and favourable conditions of work;

c) to make sure that the people with disabilities are capable to exercise their right to work and the syndicalist rights in equality conditions with the others;

d) to promote, on the labour market, the opportunities for hiring and of progress in career for the people with disabilities;

e) to hire people with disabilities in the public sector;

f) to promote the employment of people with disabilities in the private sector through politics and adequate actions.

The 27th Article is practically forcing the States Parties to take actions for inclusive the legislation and the security politics and health in work to agree with the provisions of the Convention regarding the rights of people with disabilities.

2. Legislative Aspects Regarding People with Disabilities

The rights of people with handicap from our country are guaranteed by the Romanian Constitution, which at the article 50 states: „People with handicap are enjoying of special protection. The state assures the accomplishment of a national politics of equality of chances, prevention and treatment of the handicap, for an effective participation of the people with handicap in the community's life, respecting the rights and the duties which belong to the parents and to the tutors" (Romanian Constitution, 2003).

In 2005, the Romanian Government has adopted the Decision no. 1175 from September 29, 2005, considering the approval of National Strategy for protection, integration and social fitting of people with handicap during 2006-2013. Enclose to Strategy includes multiple specifications regarding the right to work of people with handicap, as: „g) the occupation and fitting at work contributes majorly at the complete participation of people with handicap at the economic life, cultural and social, as at the personal development" (Government Decision no. 1175 from September 29, 2005).

At the elaboration of the National Strategy for protection, fitting and the social inclusion of people with handicap during 2006…2013, had been considered the European Social Charter revised (European Social Graph revised, 1996), adopted at Strasbourg at May 3, 1996, and approved by Romania through the Law no. 74/1999, documents of the Community aquis, as well and elaborated documents by non-governmental organizations which are

conducting their activity in the field of protection people with handicap. The European Social Charter revised regulates in art. 15 the right of people with handicap at autonomy, social fitting and at participation in the Community life.

Starting from the premise that people with disabilities (handicap) are and can be hired in a working process, Law no. 319/2006 of security and health in work is fitting people with disabilities in the category of groups' sensitive at risks, according to the art. 35: „The groups sensitive to certain risks, like: pregnant women, confined women, breastfeeding women, young people, as well people with disabilities, must be protected against the dangers that are affecting them in a specific way" (Law no. 319/2006). As well, it is specified at art. 36: „The employers have the obligation of arranging the work places keeping count of the presence of groups sensitive at specific risks".

People with disabilities fitted at the work place must be considered and at the activity of evaluation of professional risks, at the art. 12, paragraph 2, let. a) of the same law being established one of the employer attributions: „to accomplish and to be in the possession of an evaluation of risks for the security and health in work, including for those sensitive groups at specific risks". Evaluation of professional risks is as well regulated through Government Decision no. 1425/2006, updated through Government Decision no. 955/2010, which brings specifications concerning the revising of the evaluation (which is also concerning people with disabilities) through introducing the paragraph 3 at the art. 15: „Evaluation of risks concerning the security and health in work at the level of enterprise and/or unit, including for the sensitive groups at specific risks, must be revised, at least, in the following situations:… d) at utilizing the job post by a worker belonging to the sensitive groups at specific risks" (Government Decision no. 955/2010).

Not in the last way, the attributions of Committee of security and health in work include through others: „propose actions of arrangement of the working places, keeping count of the presence of sensitive groups at specific risks;" art. 67, let. f) from the Government Decision no. 1425/2006.

In Romania, the rights of people with disabilities are defended and promoted through the Law no. 448/2006 regarding the protection and promotion of the rights of people with handicap and the Government Decision no. 268/2007 for approval of Methodological Norms of applying the provisions of the Law no. 448/2006. Later, the law has been modified and completed through: Emergency Ordinance of the Government no. 86/2008, approved through Law no. 207 from June 02, 2009; Law no. 359 from November 20, 2009; Law no. 360 from November, 20, 2009; Emergency Ordinance of Government no. 84 from September 22, 2010. As well, the methodological Norms of applying were modified and completed through Government Decision no. 89 from February 05, 2010.

3. Case Study. The Evaluation of the Risks of Some Workers with Disabilities

Evaluations of risks of accidents and professional sickness can be performed through multiple methods: SUVA method (Bălteanu, 2008a), method of Bayesian networks (Bălteanu, 2008b), MIC method (Teleoacă, 2008), INCDPM method (Pece, 2010), in this case being used the INCDPM method.

Case study represents „Evaluation of accidents and professional sickness risks for sensitive groups at specific risks- people with disabilities" within a company with activity in the field of constructions of stations of wastewater treatment and treatment of waters. The evaluated work posts were:

1. assistant manager (woman) – the disease category: cerebral paralysis and other paralytic syndromes; functional deficiency: accentuated; it has an affection of the hip, it is moving with difficulty;

2. guardian (man) – the disease category: traumatic amputation of the fist and hand; functional deficiency: light; it has a missing finger at a hand;

3. unqualified worker (man) – disease category: disorders of temperament (affective) and mental retardation; functional deficiency: accentuated; it has an unnatural behavior.

The purpose of the made evaluation was the knowledge of the employer about the real status of security and health in work and for taking the prevention actions- protection, which are imposed for assuring the integrity and the health of the workers with disabilities.

Evaluation of the professional risks has been performed after analyzing each place of work, the analyze of the work system on its components, discussions carried with the workers with disabilities and with the employer, fact that permitted the identification of factors of risk present or possible, quantification (evaluation) of the partial risks levels on each risk factor and global on each place to work and final proposes of actions of prevention/ protection. Among the factors of risk identified, the ones that can have maxim irreversible consequences (death) over the worker with disabilities are presented in the Tables 1,…,3, function of the component of the work system.

Table 1

Risk Factors of Decease Identified at the Work Place: Assistant Manager

Production means
Hitting transport auto ways and/or railway at traveling on the route between home and the society headquarter etc.
Design of obstacles, particles (trees, pipes, windshield particles) through the windshield of the vehicle etc., the worker being a passenger.
Electrocution through direct or indirect touch: accidental deterioration of the electric installations; defects of the technical electrical equipment (especially on the alimentation part).

Table 1

Continuation

Work environment
Natural calamities (being trapped in the room by earthquake).
Worker (with disabilities)
Executing of unpredictable operations in the work task or by another manner except the procedural provisions or the ones included in the post file.
Deployment of an activity in an advanced stadium of exhausting or after administrating some medicine.
Infringement of specific instructions of electro security.
Utilizing defected technical equipment, with improvised systems or without the protection means with which the fabrication equipment was provided.
Movement, stationing on the auto access ways – at movement toward work and from the work, for accomplishing the work tasks etc.
Falling, stepping in hollow, slipping in canals, ditches, etc. – at pedestrian crossing of the routes from the exterior perimeter.
Utilizing open fire (matches, cigarettes) in places where this is not allowed.
Failure to use, after case of the specific means of protection (auto seatbelt – travelling with the job vehicle for fulfilling work tasks as a passenger).

Table 2

Factors with Decease Risk Identified at the Work Place: Guardian

Production means
Hitting by the auto transport ways during travelling-auto accidents.
Falling of objects from a high place- broken windows, materials, different objects- while performing the round etc.
Containers under pressure - compressors, bottles with technical gas, thermal power, boilers etc.
Electrocution through direct or indirect touch: accidental deterioration of electric installations; defects of the electric technical equipment (especially in the alimentation part).
Work environment
Natural calamities – lightning, flood, trees or landslides, avalanches, earthquakes (especially on the routes outside the unit).
Dangerous animals and insects (wasps, dogs etc.) present on the routes that lead to the objectives from outside the unit.
Physical aggression – in the case when the objective that it got in watch is attached by villains.
Worker (with disabilities)
Performing unexpected operations in the work task.
Running the activity under the influence of alcohol, in an advanced stadium of exhausting or after the administration of some medicine (hallucinogenic sedative and narcotics).
Performing the guard service in other conditions than those imposed by the regulations, which are defining its activity.
The infringement of the specific instructions of electro security.
Movements, standing in dangerous places (under the task of ways to lift, on other routes then the ones provided outside the unit etc.).
Falling at the same level through slipping, stumble, and imbalance.
Falling from a high place – by stepping in hollow, imbalance, slipping.
Utilizing open fire (matches, cigarettes) in places where this is not allowed.
Failure to use the individual equipment of protection and of the other means of protection supplied.

Table 3

Factors with Risk of Decease Identified at the Work Place: Unqualified Worker

Production means
Hitting transport auto ways and/or railway at traveling on the route between home and the society headquarter etc.
Accidental falling of objects, materials etc. from higher rates working in open space in the immediately vicinity of the building.
Electrocution through indirect touch at the accidental deterioration of the bonds made at the earthling system of some electric technical equipment.
Work environment
Natural calamities – earthquakes, fires.
Dangerous animals and insects (dogs, wasps) present on the outside routes.
Worker (with disabilities)
Performing unexpected operations in the work task or by another manner than the procedural provisions or the ones included in the specific instructions of the post.
Movements, standing in dangerous areas – on the access ways of the auto transport ways etc.
Falling from a small height or from height in case of working on a ladder.
Utilizing open fire (matches, cigarettes) in places where this is not allowed.
Omission of performing operations which assures the security at the place of work.
Failure to use, after case, of the individual protection equipment, of the individual working equipment or of the specific means of protection.

In which is concerning the distribution of the factors with risk of decease identified and evaluated on the work system components, the situation for all the three work places is presented in the Figs. 1 *a*, 1 *b* and 1 *c*.

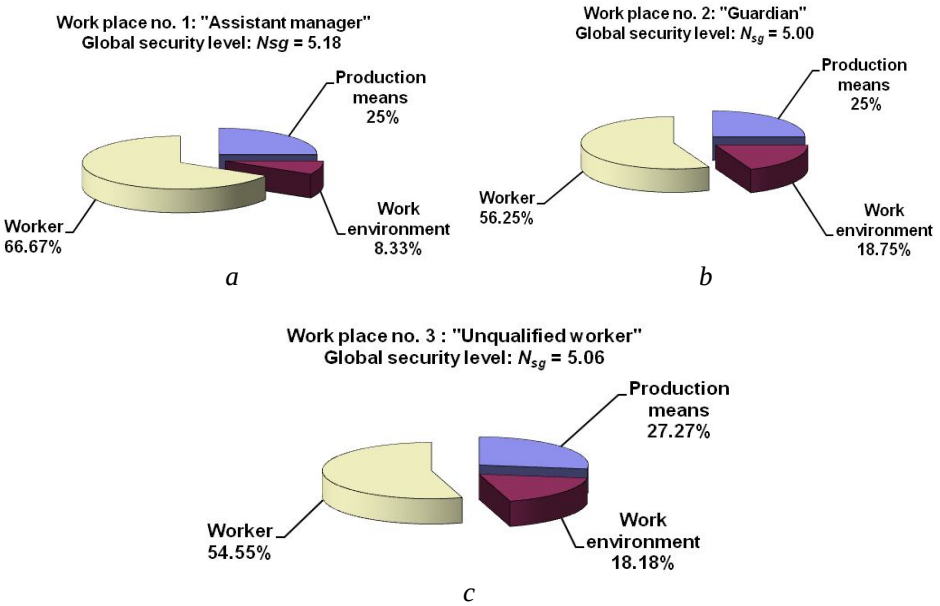


Fig. 1 – The proportion of factors with risk of decease identified after the components of the work system at work places no. 1, 2 and 3.

Hierarchy in decreasing order of those three work places after the global risk levels, with the consideration of all identified factors of risk; it is presented in Table 4.

Table 4
Hierarchy of Work Places after the Risk Level

Current No.	The name of the work place	Global risk level
1	Guardian	3.00
2	Unqualified worker	2.94
3	Assistant manager	2.82

The distribution of risk factors with maximum consequences (decease), cumulated on those three work places, after the components of the work system is presented in the following way:

a) 25.64%, risk factors belonging to the production means;

b) 15.39%, risk factors belonging to the work environment;

c) 58.79%, risk factors belonging to the worker.

It can be noticed that a significant proportion it is owned by the risk factors belonging to the worker, after which there is as proportion the risk factors belonging to the production means, and at the end there are the risk factors belonging to the work environment.

Worth to be notes is that the identified factors belonging to the work task are not from the category of those that produce maximum consequences (decease), which shows that the employer established through the post sheet clear and precise tasks for the workers with disabilities, and that they are respecting the tasks received.

The immense percentage of the risk factors belonging to the performer (58.97%) can be explained through the fact that the workers with disabilities are much vulnerable at accidents and it justifies their fitting in the category of groups sensitive to risks.

4. Conclusions

Considering the obtained results, it can be affirmed that the realized evaluation represents a necessary and useful tool for fulfilling the legal attributions, by the leadership of economical agent and by the personnel with attributions in the field of security and health in work, because it is allowing:

a) informing the workers with disabilities about the risks at which they can be exposed at the work places and about all the actions referring at the security and health at the work place;

b) if the results of the evaluation highlights an inadmissible risk for security or health of workers with disabilities, the employer takes the necessary

actions, so through a modification of work conditions and/or of the work program of the workers with disabilities, to be avoided the exposure of those at highlighted risks;

c) if the change of work conditions and/or of the work program are not possible from a technical point of view or they cannot be required in a reasonable way from well- founded reasons, the employer will take actions for changing the work place of the workers with disabilities.

For the carried activities in normal conditions, the risk factors are already known, they being identified and evaluated for each occupied work place by a person with disabilities.

REFERENCES

Bălteanu M., *Evaluation of Occupational Risks Using the Bayesians Networks*. In: Risks Evaluation, The technical-scientifically papers of the Symposium „Risks evaluation-Safe and healthy work places", Satu-Mare, October 13-15, 2008b, pp. 77-82.

Bălteanu M., *Evaluation of Particular and Occupational Risks.* In: Risks Evaluation, The technical-scientifically papers of the Symposium „Risks evaluation-Safe and healthy work places", Satu-Mare, October 13-15, 2008a, pp. 67-76.

Pece Şt., *Evaluation of Risks in the Work System.* Ed. RUBIN, Bucharest, 2010.

Teleoacă C., *Evaluation of Risks After the Indicators Key Method (IKM) for Raise-Support-Carrying-Settling in the Transports Field.* In: Risks Evaluation, The technical-scientifically papers of the Symposium „Risks evaluation-Safe and healthy work places", Satu-Mare, October 13-15, 2008, pp. 265-272.

*** Law no. *74*/1999 for ratification of the revised European Social Graph, adopted at Strasbourg on May 3, 1996.

*** European Social Graph revised, 1996.

*** Government Decision no. *1175* from September 29, 2005, concerning the approval of National Strategy for protection, integration and inclusion of people with handicap during 2006-2013.

*** Government Decision no. *1425*/2006 for approval of Methodological Norms of applying the provisions of Security and health in work Law no. *319*/2006.

*** Government Decision no. *268*/2007 for approval of Methodological norms of applying the provisions of the Law no. *448*/2006.

*** Government Decision no. *955*/2010 for modifying and completing the Methodological norms of applying of the provisions of Security and health at work Law no. *319*/2006, approved through Government Decision no. *1425*/2006.

*** Law no. *319*/2006 of security and health in work.

*** Law no. *448*/2006 concerning the protection and promoting of the rights of people with handicap.

*** Romanian Constitution, 2003.

*** *United Nations Convention Regarding the Rights of People with Disabilities*. http://infoeuropa.md/handicapati/conventia-natiunilor-unite-privind-drepturile-persoanelor-cu-dizabilitati/, 2013.

EVALUAREA PREACCIDENT A RISCURILOR PROFESIONALE ASOCIATE PERSOANELOR CU DIZABILITĂȚI

(Rezumat)

Se prezintă un studiu privind problemele, drepturile şi obligaţiile persoanelor cu dizabilităţi. La angajarea în muncă este obligatoriu să se efectueze instruirea pe linie de securitate şi sănătate în muncă a oricărui lucrător. Persoanele cu dizabilităţi (handicap) reprezintă a categorie specială de lucrători, ce este încadrată în categoria grupurilor sensibile la riscuri. Aceasta face ca atenţia ce trebuie acordată persoanelor cu dizabilităţi încadrate în muncă să fie sporită, inclusiv la evaluarea riscurilor de accidentare şi îmbolnăvire profesională. Protecţia drepturilor şi demnităţii persoanelor cu dizabilităţi (handicap) este asigurată de Convenţia privind drepturile persoanelor cu dizabilităţi, adoptată de ONU la 13 decembrie 2006. La rândul ei, România a legiferat Strategia naţională pentru protecţia, integrarea şi incluziunea socială a persoanelor cu handicap în perioada 2006-2013. Lucrarea prezintă la final un caz de integrare şi incluziune socială a trei persoane cu handicap, care au fost angajate pe posturile: asistent manager, paznic şi muncitor necalificat.

BULETINUL INSTITUTULUI POLITEHNIC DIN IAŞI
Publicat de
Universitatea Tehnică „Gheorghe Asachi” din Iaşi
Tomul LIX (LXIII), Fasc. 3, 2013
Secţia
ŞTIINŢA ŞI INGINERIA MATERIALELOR

ORGANIZATIONAL MEASURES FOR RISK PREVENTION OF MECHANICAL ACTIONS IN MECHANICAL WORKSHOPS

BY

RODICA PURCARIU* and ŞTEFAN CHICHIRĂU

Technical Colege “Mihail Sturdza” Iaşi

Received: May 05, 2013
Accepted for publication: May 17, 2013

Abstract: The evaluation of accident or professional illness risks, as well as the establishment of measures for their elimination from schools are very important actions because of the great number of participants in the educational process and the diversity of their activities. For this reason, efficient methods must be used in order to teach the students to prevent the risks and to ensure a healthy working climate.

Keywords: security and health; professional risk; risk evaluation; work accident; professional illness; partnership.

1. Introduction

The European Union Strategy in the field of Work Health and Security has identified education and preventive culture as being the key factors for maintaining and improving the quality of work. Family is an important factor for students’ education because, starting with childhood years, they are taught how to avoid certain risks. Education continues during school years.

School plays an important role in forming young people for certain fields of activity and preparing them to identify and prevent accident risks in daily life. It also aims to form a behavior to protect their health and life.

*Corresponding author: *e-mail*: purcariu_rodica@yahoo.com

Actual European Union statistics show a worrying growth of events suffered by students (accidents, work accidents, dangerous incidents). There are different causes: lack of information, lack of experience, lack of information about work health and security, lack of training in avoiding risks in daily life.

Because of the diversity of students' activities in our school (in classrooms, labs, sport field, workshop), it is necessary that a method of identifying and preventing risks should be applied.

The most efficient methods are those of realizing materials and developing activities of identification of risks and dissemination of results. For preventing accidents in our school, many technical and organizational measures have been taken. Organizational measures are described in the present paper.

2. Organizational Measures for Identification, Evaluation and Risk Prevention

As for the undergraduate education the funds assigned to Work Health and Security are minimal, it has become necessary to find solutions for evaluating and preventing accident risk with minimal costs. Thus, activities concerning accident evaluation have been organized in partnership with certain companies and experts, as well as activities in which pupils and teachers have participated.

2.1. Evaluation of Accident Risk by an External Company

An evaluation method of the National Institute of Development and Research for Work Protection has been applied, method which is named INDCPM, approved by the Work Ministry in 1993 and experimented in a PHARE Program.

The application of this method has as a final step the creation of two documents which will accompany a work place for a lifetime:

a) the evaluation file of the work place;

b) the file of prevention measures.

The method consists of the identification of all risk factors at the work place, analyzed with the help of some control lists and the measurement of risk on the combination between gravity and the maximum consequence frequency on the human body.

Finally, partially risk levels are obtained for every risk factor and the level of global risk for the entire system. Evaluation of risks is made by using a table 1of risk evaluation and the result obtained is written in the file of the work place.

Table 1

Rubric for Risk Evaluation, Combination of Consequances Gavity and Probability of their Production

			Classes of probability					
			1	2	3	4	5	6
			Extremely rarely	Very rarely	Rarely	Little freq-uently	Freq-uently	Very freq-uently
Classes of gravity			$P>10^{-1}$/an	$P>10^{-1}$/an $P<5^{-1}$/an	$P>5^{-1}$/an $P<2^{-1}$/an	$P>2^{-1}$/an $P<1^{-1}$/an	$P>1^{-1}$/an $P<1^{-1}$/an	$P>1^{-1}$/an
	Consequences							
7	Maximum	Death	**(7.1)**	**(7.2)**	**(7.3)**	**(7.4)**	**(7.5)**	**(7.6)**
6	Very serious	Invalidity 1st degree	**(6.1)**	**(6.2)**	**(6.3)**	**(6.4)**	**(6.5)**	**(6.6)**
5	Serious	Invalidity 2st degree	**(5.1)**	**(5.2)**	**(5.3)**	**(5.4)**	**(5.5)**	**(5.6)**
4	Big	Invalidity 3st degree	**(4.1)**	**(4.2)**	**(4.3)**	**(4.4)**	**(4.5)**	**(4.6)**
3	Medium	ITM 45 – 180 days	**(3.1)**	**(3.2)**	**(3.3)**	**(3.4)**	**(3.5)**	**(3.6)**
2	Little	ITM3 – 45 days	**(2.1)**	**(2.2)**	**(2.3)**	**(2.4)**	**(2.5)**	**(2.6)**
1	Negligible		**(1.1)**	**(1.2)**	**(1.3)**	**(1.4)**	**(1.5)**	**(1.6)**

Table 2

Scale Framing of Risk/Security Levels

Risk level	Cuple gravity probability	Security level
1. Minimal	(1.1) (1.2) (1.3) (1.4) (1.5) (1.6) (2.1)	7. Maximum
2. Very Low	(2.2) (2.3) (2.4) (3.1) (3.2) (4.1)	6. Very High
3. Low	(2.5) (2.6) (3.3) (3.4) (4.2) (5.1) (6.1) (7.1)	5. High
4. Medium	(3.5) (3.6) (4.3) (4.4) (5.2) (5.3) (6.2) (7.2)	4. Medium
5. High	(4.5) (4.6) (5.4) (5.5) (6.3) (7.3)	3. Low
6. Very high	(5.6) (6.4) (6.5) (7.4)	2. Fvery Low
7. Maximum	(6.6) (7.5) (7.6)	1. Minimal

For exemplification, we show the modality of risk evaluation for a mechanic instructor in the workshop.

The global level of risk is calculated as follows:

$$\mathrm{Nrg}_{12} = \frac{\sum_{i=1}^{26} r_i R_i}{\sum_{i=1}^{26} r_i} = \frac{4(4\times 4)+17(3\times 3)+(2\times 2)}{4\times 4+17\times 3+5\times 2} = \frac{237}{77} = 3.07, \quad (1)$$

where: Nr is the global level of risk for a work place; r_i – i risk factor grade; R_i – level of risk for i risk factor; N – number of risk factors identified at the work place.

The graphical representation of partial risk levels on risk factors is in Fig. 1.

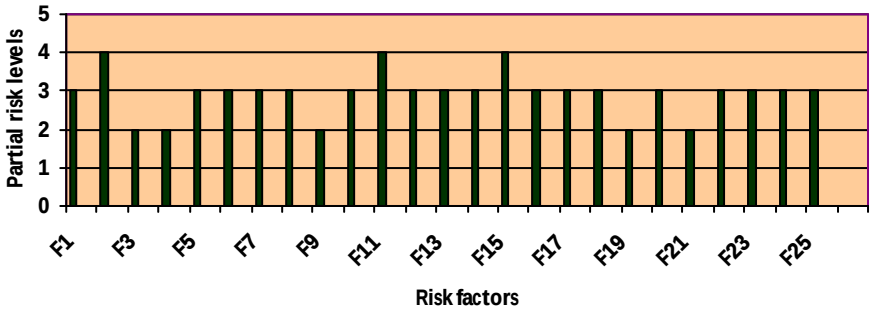


Fig. 1 – Partial risk levels on risk factors.

Table 3
Presentation of Risk Factors

Risk factors	
F1	Dynamic mechanism
F2	Cutting, pricking in contact with dangerous surfaces
F3	Falling from the same level through slipping
…..	…….
F22	Action aside from work duties
F23	Adjusting mechanisms while functioning
F24	Interventions in dangerous regions while functioning
F25	Unusing of protection devices
F26	Unusing of protection equipment

2.2. Evaluation of Accident Risks in Partnership with the Work Inspectorate of Iaşi

The partnership with the Work Inspectorate of Iasi was benefic because of the project Partnership for a Healthy and Secure School which succeeded in completing a guide of evaluation of risks in schools.

In this situation, a group of risk evaluation was funded, group formed of students. The students represented the dynamic and nonconformist element of the group. They proved reliability, implication, inventiveness and they got familiarized with notions related to Work Health and Security (SSM).

There have been identified a series of real and potential risks which don't refer strictly to work, but also to the activities in the educational field, such as physical risks (slipping, falling from a higher level, noise generated by mobile electronic equipments – phones, I pod or violence in school), chemical and biological risks, psycho-social risks.

The members of the team are:

a) school headmaster;

b) the person who represents the Health and Security domain in our school;

c) a doctor;

d) representatives of the Administration (4 teachers and the administrator);

e) representatives of the school syndicate (3 persons);

f) students of all school levels (4 for each level).

After applying the guide and the risk evaluation, there have been established:

a) regions with high risk of accidents;

b) causes which produce accidents and professional illness;

c) consequences of accidents;

d) measures which must be taken for eliminating risks.

Table 4

Identifying File and Description of the Work Place

<table>
<tr><td>Name of the work place</td><td colspan="4">Wrkshop for car service</td></tr>
<tr><td>Emplacement of the work place</td><td colspan="4">School workshop – ground floor</td></tr>
<tr><td rowspan="5">Number of workers</td><td rowspan="5">4</td><td colspan="2">Of which</td><td colspan="2">Of which</td></tr>
<tr><td rowspan="4">women
0</td><td rowspan="4">men
4</td><td>Disability</td><td>0</td></tr>
<tr><td>Pregnant women</td><td>0</td></tr>
<tr><td>Old persons</td><td>0</td></tr>
<tr><td>Young persons</td><td>0</td></tr>
<tr><td>Jobs</td><td colspan="4">Car – engineer, car electrician, locksmiths for universal service</td></tr>
<tr><td>Other participants</td><td colspan="4">Pupils (30 pupils of a class who are practising in the workshop)</td></tr>
<tr><td colspan="5">Detailed description of work place. Universal and car service activities, electric, installations.</td></tr>
<tr><td>Furniture</td><td colspan="4">Table, chairs, locker rooms</td></tr>
<tr><td>Tehnical equipments</td><td colspan="4">Transport equipments, drills, polishers, lathes, welding machines</td></tr>
<tr><td>EIP</td><td colspan="4">Gloves, boots, protection glasses, robes, leather apron, protection handle</td></tr>
<tr><td>Work environment</td><td colspan="4">Natural ventilation (through open windows), natural and artificial lighting.</td></tr>
</table>

Risks: electric shock; slipping; hurting; cutting; crushing; puncture; burning; intoxication; irradiation; falling.

Active participation of students in dissemination activities and in the creation of materials has been really important. Thus, students achieved films and posters in which accident risks are presented, risks which can appear during different activities (risks of falling from a higher level, risks of slipping on a wet floor, risks of hurting by coming into contact with different pieces of furniture while playing, violent behavior).

The evaluation team students programmed different activities for disseminating information for the other pupils, especially for those in the 9th and 10th grades, because they are less informed about risks.

Fig. 2 – Images presenting the activity of risk evaluation.

Students were really interested in those activities, they paid attention, participated in discussions and described different situations of accident risks in their life experience

By presenting these information, the activity regarding accident risks and identification of prevention measures was really efficient.

3. Conclusions

Because of the great number of participants in the educational process, especially in the practical activities in workshops, it is necessary to achieve an evaluation of accident risks, a continuous training of students, teachers and other participants in the teaching process.

Participation of pupils in risk evaluation activities and in dissemination of information activities for establishing the necessary measures to eliminate

them contributes to a better acknowledgement by students of accident risks, a decrease of risks and it brings several advantages such as:

a) development of creative thinking;

b) development of information communication skills, of selection and presentation abilities.

Forming abilities of identifying accident risks and of establishing methods to be used in combating them.

REFERENCES

Albulescu A.G., Căldărescu G., Tanasievici D., Baciu C., Purcariu R. *et al., Securitate şi Sănătate în Muncă*. Manual, clasa a IX-a, ;I a X-a, ediția 2010.

Andrei George Albulescu, Gabriela Căldărescu, Daniel Tanasievici, Purcariu Rodica *et al., Securitate şi Sănătate în Muncă*. Manual, clasa a IX-a, ediția 2010.

Pece Şt., Băltărețiu J. *et al., Curs Securitatea muncii*. Univ. Tehnică, Petroşani, 1993.

* * * http://startsigur.protecția muncii.ro.

* * * http://www.protecția muncii.ro.

* * * Legea Securității şi Sănătății în Muncă nr. *319*/2006.

* * * *Standard de pregătire profesională*. Ministerul Educației Cercetării şi Tineretului, Anexa 2 la OMEdC nr. *1847* din 29.08.2007.

MĂSURI ORGANIZATORICE PENTRU PREVENIREA RISCURILOR DATORATE ACȚIONĂRILOR MECANICE LA LOCURILE DE MUNCĂ DIN ATELIERELE MECANICE

(Rezumat)

Evaluarea riscurilor de accidentare şi îmbolnăvire profesională precum şi stabilirea măsurilor de eliminare a acestora în şcoală, constituie o activitate cu o importanță deosebită datorită numărului mare de participanți la procesul instructiv-educativ şi diversității activităților realizate de aceştia. În acest scop trebuie aplicate cele mai eficiente metode pentru conştientizarea în special a elevilor, asupra riscurilor şi asigurarea în şcoală a unui climat de muncă sigur şi sănătos.

Sunt prezentate câteva măsuri organizatorice aplicate în şcoală, pentru identificasrea, evaluarea şi combaterea riscurilor de acidentare în. Se evidențiază participarea activă a elevilor la activitățile de evaluare a riscurilor şi de diseminare a informațiilor privind riscurile de accidentare în şcoală..

BULETINUL INSTITUTULUI POLITEHNIC DIN IAŞI
Publicat de
Universitatea Tehnică „Gheorghe Asachi” din Iaşi
Tomul LIX (LXIII), Fasc. 3, 2013
Secția
ŞTIINȚA ŞI INGINERIA MATERIALELOR

NON-IONIZING ELECTROMAGNETIC RADIATION INFLUENCE ON LIFE QUALITY

BY

GILDA RUSU-ZAGĂR*, IONEL IORGA, CĂTĂLIN RUSU-ZAGĂR and ANDREI IORGA

The National Research and Development Institute of Occupational Safety (INCDPM) - “Alexandru Darabonț”

Received: May 05, 2013
Accepted for publication: May 17, 2013

Abstract: Constant concern for quality of life and the use of advanced industrial technologies has led to the late twentieth century, the explosion of the number of sources of non-ionizing electromagnetic radiation from microwave and radio frequency band while increasing public interest and specialists for health risk assessment. Case study presented aims to ionizing radiation monitoring across multiple sources transceiver, to take implicative factors by risk reduction measures in order to increase the safety and health at workplaces. In a context of scientific uncertainty regarding the effects of exposure to electromagnetic fields it is recommended adoption of the precautionary principle by implementing administrative measures, information and training of the population, particularly those at risk of exposure to sources and not least support from decision makers on the development of adequate logistics for monitoring electromagnetic fields and their effects in the long term.

Keywords: non-ionizing radiation; electromagnetic fields; security; health; work.

1. Introduction

Electromagnetic waves are transverse waves that have magnetic components and an electrical component, electric and magnetic vectors are perpendicular to each other and to the direction of propagation.

*Corresponding author: *e-mail*: gildarusuzagar@yahoo.com

The main sources of radiofrequency electromagnetic fields are antennas that emit radio and television programs, mobile antennas, communication antennas (army, air traffic, police, fire or emergency services), mobile devices, traffic surveillance installations, microwave ovens, cordless landline phones antennas, security systems and more. CRT-type computer monitor, is a source of electromagnetic wave radiation from the cathode ray tube, and the most dangerous are extremely low frequency radiation. (Albert *et al*., 2005; Ken *et al*.,2007; http://www.bioone.org/bioone/7587...)

2. Spectrum of Electromagnetic Radiation

The spectrum of electromagnetic radiation is divided by wavelength criterion in several areas, from the lower frequencies to the high ones: radiation (waves) radio, microwave, radio radiation, infrared radiation, light radiation, ultraviolet radiation, *X*-rays (Rontgen) radiation "γ "(gamma) (Fig. 1) (Goiceanu, 2003; Ferrante *et al*., 2004).

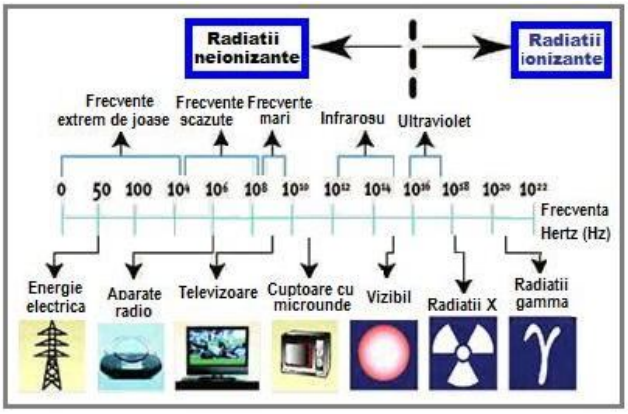


Fig.1 – Types of sources depending on the frequency of emission (http://images.google.ro).

2.1. Non-Ionizing Electromagnetic Radiation from Microwave and Radio Frequency Band

These are radiations with frequencies between 3 kHz and 300 GHz whose energy does not cause ionization of matter.

The electromagnetic field can be divided into two main components: the radiative and reactive:

i) *reactive components* refers to the energy stored in the vicinity of the source and is responsible for the effects on humans. This region is located around the source, up to a distance of approximately 1/6 m ~ 2 m.

ii) *radiative component* is at distances greater than a wavelength, this region is called the region and the far field.

3. Effects of Electromagnetic Fields on Human Health

The effects of RF fields on tissues may be both thermal and non-thermal.

1. *Thermal effects* occur due to electrical conductivity of most biological tissues. It is believed that as long as ICNIRP limits are not exceeded, the occurrence of biological effects due to thermal effects is unlikely (Deliu & Calotă, 2006; Bernhardt, 1992; Goiceanu, 2003).

2**.** *Non-thermal effects* can occur due to many interactions between the electric field and the different components of biological tissues, such as changes in the conformation of the protein or effects on binding of receptor-mediated cell – Ca2+, processes which in turn triggers an intra-and intercellular cascade of events.

In terms of epidemiological studies we can say the following:

i) RF radiation can lead to adverse thermal effects only if the limits proposed by ICNIRP are exceeded (Deliu & Calotă, 2006; http://www.icnirp.de/ what.htm; http://www.acero.ro/bul8.pdf);

ii) pulsed fields may cause hearing effects which does not cause long-term effects on health;

iii) RF fields that population may be exposed to cannot cause ocular cataracts;

iv) There is little epidemiological data on fertility in women exposed to radiation, and the results are uncertain.

In a context of scientific uncertainty about the effects of exposure to electromagnetic fields, adoption of the precautionary principle is recommended by implementing administrative measures, for example, the placing of mobile antennas away from areas where activities with children or sick person, prohibition of the use of mobile phones by children younger than 16 years, of information and training of the population, namely the pursuit of health state, especially in individuals at risk of exposure to sources (electrical pillows users, physiotherapy procedures, etc..) and not the least, support from policy makers on developing adequate logistics for monitoring fields and effects (Kheifets & Oksuzyan, 2010; http://www.icnirp.de/what.htm; http://jnci.oxfordjournals.org/cgi/content/full/99/8/655; www.who.int/mediacentre/factsheets/fs296/en/index.html).

4. Action-Triggering Values

The action-triggering values provided in Table.1 are obtained from exposure limit values in accordance with the principles established by the

International Commission for Non-Ionizing Radiation Protection (ICNIRP), in its guidelines on limiting exposure to non-ionizing radiation (ICNIRP 7/99). (Resolution no. 1136; http://wpcontent.answers.com).

The precautionary principle certificated in the Treaty of the European Union (the Maastricht Treaty Art.130R-7 feb.1992) states that when there is sufficient scientific evidence, in the absence of absolute certainty or evidence, taking into account the scientific and technical knowledge of the time, the authorities must protect, above all, the citizens, against the danger and damage caused by exposure to EMF and should not delay taking of measures to avoid the risk of serious and irreversible environmental damage (Resolution no. 1136; http://wpcontent.answers.com).

Table 1
The Action-Triggering Values in Accordance with Decision No. 1136 of August 30, 2006

Frequency range	Electric field intensity (rms values, average 6 min) E, [V/m]	Magnetic field intensity (rms values averaged over 6 min) H, [A/m]	Density equivalent plane wave power (rms values averaged over 6 min) S, [W/m^2]
65…100 kHz	610	1,600/f	–
100 kHz	610	16	–
100…400 MHz	61	0,16	10
400…2000 MHz	$3f^{1/2}$	$0.008f^{1/2}$	f/40
1v800 MHz	127.2	0.33	45
2…300 GHz	137	0.36	50

f is the frequency in the units indicated in the frequency range column.

5. Case Study

Monitoring were conducted at different electromagnetic field sources in the special services: army, air traffic, police, fire and emergency services (Table 2) using a device type RADIATION METERS FOR ISOTROPIC MEASUREMENT OF ELECTROMAGNETIC FIELDS, EMR – 300 accessories (probes for measuring electric field strength and power density – absolute error ± 2 dB).

From Table 2 after analyzing the measured values in accordance with the legislation in force (Resolution no. 1136) we can see that there were overruns in intensity of the electric field and power density for portable radiotelephone transceiver stations. For frequency range (100…400 MHz) electric field strength and power density for the equivalent plane wave go beyond the limits of 61 V/m and 10S, [W/m^2], (Table 1), at allportable radiotelephone transceiver stations (Table 2).

Table 2
Sources of Electromagnetic Field

No. Crt	Source	Frequency range	Electric field intensity (rms values averaged over 6 min) *E*, [V/m]	Magnetic field intensity (rms values averaged over 6 min) *H*, [A/m]	Equivalent density plane wave power (rms values averaged over 6 min) *S*, [W/m^2]
1	LCD monitors	100 kHz	1.39	0.1684	–
2	IJPF antennas, STS	(100-400) MHz	2.55	–	0.0172
3	Telecom Equipment	1 GHz	0.72	–	0.0013
4	ILS runway system view	(100-400) MHz	0.50	–	0.0006
5	Radar signal generation equipment	1030 MHz	0.34	–	0.0003
6	Ground-air stations RHODE-SCHWARTZ, model simulators	(118-136) MHz	1.0	–	0.0026
7	Broadcast stations-reception type MOTOROLA GP 340 portable radio	(100-400) MHz	65.4	–	11.34
8	Broadcast stations-reception portable radio the Motorola TEAM	(100-400) MHz	65.66	–	11.43
9	Servers	(2.5 to 3) GHz	0.53	–	0.0010
10	Broadcast stations-MOTOROLA portable radio reception MTH type 800L	(100 -400) MHz	62.2	–	10.26
11	Broadcast stations-portable radio reception type HYT TC 700	(100 -400) MHz	70.8	–	13.29

Table 2
Continuation

No. Crt	Source	Frequency range	Electric field intensity (rms values averaged over 6 min) *E*, [V/m]	Magnetic field intensity (rms values averaged over 6 min) *H*, [A/m]	Equivalent density plane wave power (rms values averaged over 6 min) *S*, [W/m^2]
12	Broadcast stations-portable radio reception MOTOROLA type MTH 800	(100 -400) MHz	61.9	–	10.16
13	Broadcast stations-reception type MATRA portable radio-telephone	(100 -400) MHz	71.55	–	13.57
14	Broadcast stations-portable radio reception type MOTOROLA CP 140	(100 -400) MHz	70.39	–	13.14
15	Broadcast stations-portable radio reception IEMI type SD 506	(100 -400) MHz	62.7	–	10.42
16	Broadcast stations-portable radio reception IEMI type SD 508	(100 -400) MHz	72.02	–	13.75
17	Broadcast stations-portable radio reception type MS 505	(100-400) MHz	65.3	–	11.31

The explanation is that the antenna of this type of portable radios is close to the user's ear during both emission and during the reception.

From the analysis of Fig. 2, one finds that the electromagnetic field produced by portable radiotelephones during operation, decreases with increasing distance, reaching about 20 cm to be void.

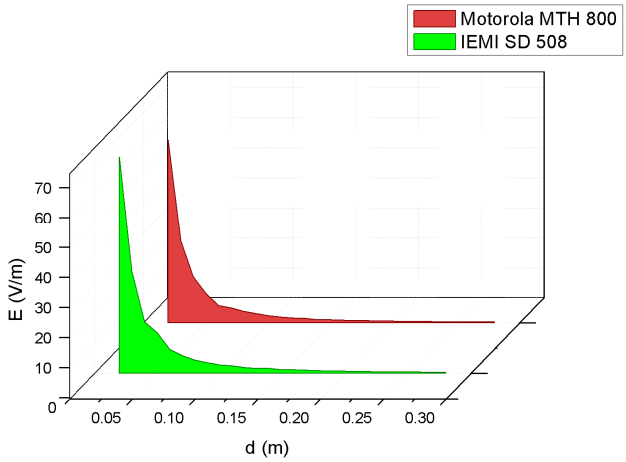


Fig. 2 – Variation of the electric field with the distance for two types of portable radios (Motorola MTH 800 and SD 508 IEMI).

6. Conclusions

After measuring the electromagnetic field parameters there were obtained particularly high values for portable radiotelephone transceiver radios (Table 2) with frequencies which are in the range (100-400) MHz, in periods functioning emission at distances of Use (below 15 cm).

To increase the safety and health at workplaces, it is recommended to limit the duration and intensity of exposure as much as possible by using these portable stations at a distance of 20 cm.

Risks arising from exposure to electromagnetic fields should be eliminated or minimized in accordance with the law, taking account of technical progress and the availability of measures to control the risk.

In order to prevent and detect as quickly as possible of any harmful effects on health resulting from exposure to electromagnetic fields, there should be ensured an adequate supervision of health workers, in accordance with Art. 24 and 25 of Law no. *319*/2006.

REFERENCES

Albert N., Sherif M.F., Papadopoulos N.J., Slaby F.J., Monahan J., *Effect of Nonionizing Radiation on the Purkinje Cells of the Rat Cerebellum.* Bioelectromagnetics, **2**, 247-257 (2005).

Bernhardt J.H., *Non-Ionizing Radiation Safety: Radiofrequency Radiation, Electric and Magnetic Fields*. Phys. Med. Biol., **37**, 807-844 (1992).

Deliu N., Calotă V., *Câmpurile electromagnetice şi efectele acestora asupra stării de sănătate*. I.S.P.B, 2006.

Goiceanu C., *Contributii la studiul influentei campurilor electromagnetice asupra sistemelor biologice*. Univ. Al. I Cuza Iasi, Facultatea de Fizica, martie 2003.

Ferrante G. , Zarcone M., Uryupin S.A., *Infrared Radiation Harmonic Generation in Degenerate Semiconductors*. The European Physical Journal B - Condensed Matter and Complex Systems, **42**, *1*(2004).

Ken K.K., Geza B., Malcolm R.S., Timo K., Graham G., *Occupational Exposure to Ionizing and Non-Ionizing Radiation and Risk of Glioma*. Occupational Medicine, **57**, *7*, 518-524 (2007).

Kheifets L., Oksuzyan S., *Exposure Assessment And other Challenges in Non-Ionizing Radiation Studies of Childhood Leukaemia*. Athens Greece, **132**, 139-147 (2010).

Zhang, Hong-qi Zhang., Pan W., *Electromagnetic Field of a Vertical Electric Dipole on a Perfect Conductor Coated with a Dielectric Layer*. Radio Sci., **37**, *4* (2002)

* * * World Health Organization, International Comission on Non-Ionizing Radiation Protection (ICNIRP), Health issues related to the use of hand-held radiotelephones and base transmitters, Health Physics, Vol.70, No.4, pp 587-593, 1996. (pdf - 1307 KB), http://www.icnirp.org

* * * *Health Effects from Radiofrequency Electromagnetic Fields*. Report of an Independent Advisory Group on Non -Ionising Radiation, 2003

* * * Resolution no. *1136* of 30 August 2006 on the minimum health and safety requirements regarding the exposure of workers to the risks arising from electromagnetic fields.

* * * http://www.icnirp.de/what.htm

* * * http://www.bioone.org/bioone/7587&volume=162&issue=02&page=0219

* * * http://jnci.oxfordjournals.org/cgi/content/full/99/8/655

* * * www.who.int/mediacentre/factsheets/fs296/en/index.html

* * * http://www.acero.ro/bul8.pdf

* * * http://wpcontent.answers.com

* * * http://images.google.ro

RADIAŢII ELECTROMAGNETICE NEIONIZANTE. INFLUENŢA ASUPRA CALITĂŢII VIEŢII

(Rezumat)

Preocuparea constantă pentru îmbunătăţirea calităţii vieţii şi pentru utilizarea unor tehnologii industriale performante a determinat, la sfârşitul secolului XX, explozia numărului de surse de radiaţii electromagnetice neionizante din banda microunde şi radiofrecvenţă concomitent cu creşterea interesului populaţiei şi al specialiştilor pentru evaluarea riscurilor pentru sănătate. Studiu de caz prezentat urmareşte monitorizarea radiaţiilor neionizante la nivelul mai multor surse de emisie-receptie, în scopul luării de

către factorii implicativi a măsurilor de reducere a riscului în scopul creşterii securităţii şi sănătăţii la locurile de muncă. În contextul existenţei incertitudinii ştiinţifice privind efectele expunerii la câmpuri electromagnetice, se recomandă adoptarea principiului de precauţie prin implementarea unor măsuri administrative, informarea şi formarea populaţiei, mai ales a persoanelor cu risc de expunere la surse şi nu în ultimul rând susţinere din partea factorilor de decizie cu privire la dezvoltarea unei logistici adecvate de monitorizare a câmpurilor elecromagnetice şi a efectelor acestora pe termen lung.

BULETINUL INSTITUTULUI POLITEHNIC DIN IAŞI
Publicat de
Universitatea Tehnică „Gheorghe Asachi” din Iaşi
Tomul LIX (LXIII), Fasc. 3, 2013
Secția
ŞTIINȚA ŞI INGINERIA MATERIALELOR

SAFE AND HEALTHY WORKPLACES IN THE EDUCATIOAL UNITS. THE MICROCLIMATE IN THE WORKPLACE ENVIRONMENT

BY

GILDA RUSU-ZAGĂR*, CĂTĂLIN RUSU-ZAGĂR, IONEL IORGA, CĂTĂLIN RUSU-ZAGĂR and ANDREI IORGA

The National Research and Development Institute of Occupational Safety (INCDPM) - “Alexandru Darabonț”

Received: May 05, 2013
Accepted for publication: May 17, 2013

Abstract: The integration of occupational safety and health (OSH) with education represents, at European level, an essential component concerning the development of risk prevention culture. This allows everybody, teachers and children alike, to learn how to live and work in a safe and healthy environment.

Safety and health at the workplaces represents a very important objective with a leading role in the increasing of the quality of life. At the workplaces from the educational system, the risk factors should be known so as the necessary protection measures may be taken. The microclimate parameters are risk factors whose measured values (temperature, humidity, air draughts), above or below the limits recommended by the current standards can influence the safety and health of workers and students alike.

Keywords: microclimate; education; health; safety; labor.

1. Introduction

The working environment is represented by the environment in which the worker performs his activity at the workplace.

*Corresponding author: *e-mail*: gildarusuzagar@yahoo.com

The working environment includes, on the one hand, the physical surrounding environment {workspace, lighting conditions, microclimate (temperature, humidity, air currents), noise, vibrations, radiations, air purity}, and, on the other hand, the social environment.

The microclimate at the workplace. A part of the physical working environment consists of all the conditions of temperature, humidity, air flow velocity and intensity of caloric radiations that characterize the state of the air inside a confined workspace or in the vicinity of some technical systems housed in this space.

The microclimate *at the workplace*:

a) influences the safety, the health and the working capacity of the contractors when its parameters do not fall within certain limits of comfort according to the regulations in force;

b) is determined by: the temperature and the air humidity air, the air flow velocity, the surface temperature and the caloric radiation emitted in the working area.

The microclimate in the workplace must provide the workers with the maintenance of the thermal balance, according to the amount of heat generated by the body and to the activity they carry on.

In the thermoregulatory mechanism, all the microclimate parameters act simultaneously and are mutually interdependent, depending on the physical effort. (Aris *et al*.,1993; Jagjit, 1996)

2. The Control of the Thermal Ambiance

The achievement of the thermal comfort in an indoor space also involves reaching and maintaining a preset temperature, humidity, air flow velocity, content of pollutants. This request is performed by a certain rate of air renewal, which is variable depending on the destination of the indoor space.

The human thermal comfort is defined as the totality of the conditions for which a person would not prefer a different environment.

It is a complex concept because it depends on a number of physical parameters, organic and external ones. The parameters that influence the thermal comfort fall into three categories:

a) *the physical parameters* which include: air temperature, average temperature, radiant enclosure walls, relative air humidity, relative air velocity inside the enclosure, atmospheric pressure, light intensity, noise level;

b) *organic parameters* including: age, gender;

c) *external parameters* include: the human activity level, clothing type, social conditions.

Among these, the physical parameters have the greatest influence on the thermal comfort.

3. Effects on the Body

The indoor microclimate depends on the technological requirements of production or on the required conditions of comfort..The feeling of comfort is determined by the heat exchange between the human body and the environment.Depending on the ratio which exists between the heat generated and the heat wasted in the ambiance, we have the following types of sensations:

a) the sensation of cold;

b) the sensation of warmth ;

c) the sensation of thermal comfort.

1. *The air temperature* is the most important climatic factor with pathogenic action as value and variability pathogenic determines the physiological reactions that stimulate or, conversely, limit the effort capacity of the human body and, in addition, provides favorable conditions for the development of pathogens agents. Achieving a thermal ambiance corresponding to the physiological wellbeing of the body (subjective temperature) is based on a stable balance between the environmental temperature and humidity, as follows:

a) *if the temperature falls*, the body reacts by both peripheral vasoconstriction with the reduction of the heat loss and by increasing the thermogenesis:

a_1) the metabolism increases several times over the normal value;

a_2) increasing the muscle tone - "shivering with cold"

b) *if the temperature rises* above the upper limit of the thermal neutral zone (32^0C), it causes an adaptive response that consists of:

b_1) increasing the flow swelter up to 1.3 kg/h. If the respective liquid is not replaced, a state of water deficit can be reached (during the office hours up to 6% of the body weight). Together with the sweat, other constituents are also lost (sodium, vitamins, etc.);

b_2) activating the blood flood with the increase in the circulatory flow;

b_3) increasing the respiratory rate.

The temperature of the working environment influences the health and the performances of the employees by:

a) a combination of temperature with the humidity;

b) the duration of exposure to thermal conditions outside the comfort zone, in which case it is the acclimatization is necessary;

c) the temperature of the objects and tools with which the work is done. Large differences (object temperature over 43°C or below 0°C) between the body temperature and that of the tools can cause pain or even destroy tissues.

At higher ambient temperatures, the human body loses less heat by radiation and convection than at low temperatures and, in order to restore its balance, compensates by a higher evaporation (sweating).

As evaporation is favored by low moisture content, we have the same feeling of comfort in a warm but dry atmosphere as in a cold but more humid atmosphere.

Therefore, the human thermoregulation mechanism works on the thermostat principle controlling permanently the internal body temperature deviations from the physiological threshold reference: 37°C to 35°C in the central and peripheral area of the skin.

2. *Relative humidity.* The human body is sensitive to the variation of relative humidity, the values above 70% and below 30% being considered outside the zone of thermal comfort for most occupants of the premises.

The limit inferior to 30%, situation in which the man begins to feel the sensation of dryness. Under 25%, there are adverse impacst on the structures and functions of the respiratory mucosa ensuring the removal of impurities (including nucleation) of the inspired air.

The upper limit is subject to the sensation of stuffiness. More than 75%, in terms of the performing hard work, has an adverse effect on the process of thermolysis (up to heat shock) (H.G. 1425 din 30.10.2006; SR EN 7730/2006).

3. *The air movement velocity* exerts a large influence on the heat exchange of the body, breathing processes, energy consumption, neuropsychological status.

The influence of the air movements on the metabolism is manifested by increased heat loss, first of all due to the convection, because the moving air blows away from the body the closest heated layers, and their place is taken by the cold air.

The maximum admitted velocity of the air in an indoor space is measured according to the temperature determined by the convective heat exchange between man and environment. Depending on air velocity in the working area, *the feeling of air flow appears*.

4. Measurement/Calculations of Microclimate Parameters According to Regulations in Force

4.1. Measurement/Calculation of Microclimate Parameters According to SR EN 27243

The detailed analysis of the environment influence on thermal stress requires the knowledge of the following four main sizes: air temperature, average radiation temperature, air velocity, absolute humidity.

Identifying the metabolism class by type of activity, according to Table 1.

Tabel 1
Classification of Metabolism Levels

Class	The field values of the metabolism M		Value used for calculating average metabolism		Examples of activities
	Per unit skin surface W/m^2	For average skin surface of 1.8 m^2	W/m^2	W	
0 Rest	M≤65	M ≤ 117	65	117	Rest
1 Reduced metabolism	65< M ≤ 130	117<M ≤ 234	100	180	Sitting comfortably: easy manual work (writing, typing, drawing, sewing, calculating) working with the hands and arms (with small tools, testing, packaging and sorting lightweight materials) activity with arms and legs (driving under normal conditions, operation of a foot switch or pedal) Standing: drilling (small pieces), milling (small pieces); winding screwing the small valves, processing with low-power process-sing tools; walking occasionally (speed up to 3.5 Km/h).
2 Metabolism medium	130<M ≤ 200	234<M≤360	165	297	Constant activity of the hands and arms (nailing, sawing) activity of the arms and legs (handling trucks, tractors on site); arms and body activity (working with pneumatic hammer, joining vehicles, works in plaster, intermittent handling of moderately heavy materials, grinding, hoeing, picking fruit or vegetables); Pushing or pulling light carts or wheelbarrows; walking at a speed of speed of 3.5 km / h to 5.5 km / h, forging.
3 Intense Metabolism	200<M≤260	360<M≤468	230	414	Intense activity of the arms and body: transport of heavy materials, rowing; hammering; cutting; planning or shaping hardwood, hand mowing, digging, walking speed of 5.5 km / h to 7km / h. Pushing or pulling very heavy carts or wheelbarrows with arms cleaning the castings chip, placing concrete blocks.
4 Very intense Metabolism	M>260	M>468	290	522	Intense activity at fast pace, almost maximum: working with an ax, working with a shovel or digging intensely, climbing stairs, a ramp or a ladder, walking quickly with small steps, running, walking at a speed greater than 7Km / h

4.2. Operative Temperature

Temperature evenly distributed on the surface of an imaginary black tire with which a person exchanges the same amount of heat by radiation and convection as in the environment in question.

The operative temperature is calculated using the formula:

$$t_0 = At_a + (1 - A)t_r, \quad (2)$$

where: t_a is the dry temperature of the air, [°C]; t_r – is the average radiation temperature, [°C]; v – air flow velocity, [m/s].

The average radiant temperature: the temperature evenly distributed on the surface of an imaginary black tire with which a person exchanges the same amount of heat by radiation as in the environment question. It is measured directly with the globe thermometer.

Table 2

Classification of A Values Depending on the Air Flow Velocity

v_{ar}	< 0.2 m/s	0.2...0.6 m/s	0.7...1 m/s
A	0.5	0.6	0.7

If the difference between the radiation average temperature and the air temperature is lower than 4°C, the operating temperature can be calculated as the average of the values of air temperature and of the radiation average temperature.

4.3. Measurement of Air Relative Humidity

The humidity can be measured in a single place within the indoor space so that the pressure of the water vapors can be considered uniform throughout the whole indoor area.

Relative humidity: the amount of water vapors in the air (or water droplets or ice crystals), expressed as a percentage by the ratio between the amount of vapor in the air at a given moment and the maximum possible (when the air is fully saturated).

In other words, it is the ratio between the partial pressure of the water vapors and the saturation pressure at a given temperature and pressure.

Relative humidity values above 70% and below 30% are considered outside the thermal comfort for most occupants of the premises.

5. Interpretation of the Measured Parameters Value

The measured values are interpreted in relation with the minimum and maximum thermal limits recommended by the standards in force EN 27243/1996 "Warm Ambience”.

The estimation of the heat stress on the working man based on the WBGT index (wet temperature and globe thermometer) "EN ISO 7730" Moderate ambient heat".

The analytical determination and interpretation of the thermal comfort by calculating the PMV and PPD indices and specifying the local thermal comfort criteria "* STAS 13040/1991 Machinery and tools for construction. The cabin microclimate. Determination methods."

Tabel 3

Recommended Conditions of the Standard SR EN 7730/2006 for Microclimate Parameters

Type of room	Activity W/m^2	Operative Temperature, [°C]	Airflow speed* m/s		
		Summer (warm season)	Winter (cold season)	Summer (warm season)	Winter (cold season)
Office	70	24.5±1.0–24.5±2.5	22.0±1.0–22.0±3.0	0.12–0.24	0.10–0.21
Office reception					
Classrooms	81	23.5±1.0–23.5±2.5	20.0±1.0–22.0±3.5	0.11-0.23	0.10–0.19**
Kindergarten	93	23.0±1.0–23.0±3.0	19.0±1.5–19.0±4.0	0.16–0.23	0.13–0.18**

* For 60% relative humidity in summer and 40% in winter

** For values $\geq 20^0$C

Tabel 4

The Metabolic Rate / Different Types of Activities According to SR EN ISO 7730/2006

Activity	Metabolic rate	
	W/m^2	Met
Leisure	46	0.8
Sitting down, relaxed	58	1.0
Sedentary activity(office, home, school, laboratory)	70	1.2

6. Case Study

Monitoring the microclimate workspace in the physics laboratory.

Within the physics laboratory of an education unit, the microclimate parameters presented in Table 8 have been monitored. The activities in the laboratory in which both the graduate and undergraduate qualified personnel is involved , are carried out with a low metabolism consumption (Table 1, SR EN 27243/1966).

Table 5

Values of the Measured Microclimate Parameters/Calculated in the Laboratory

Workstation	Place of measurement microclimate parameters	The average speed of air draughts*, [m/s]	Air relative humidity*, [%]	Dry temperature*, [^{0}C]	Wet temperature*	Average radiation temperature*, [^{0}C]	Operating temperature	I_{Cl}***	PMV****	PPD****, [%]
Laboratory	Besides office workstation	**0.1**	**60**	30	28.4	29.2	**29.6**	1.0	2.02	77.8

* Values obtained by direct measurement using the devices Microtherm Heat Stress WBGT-CASELLA and TESTO 43;

** The operative temperature is calculated using the relation 2;

*** I_{Cl} by identifying the type of work equipment in accordance with SR EN ISO 9920/2007 standard "Ergonomics of the thermal environment. Determination of thermal insulation and evaporative resistance of a clothing ensemble";

**** Calculation of PMV and PPD using JAVA applet calculation program for ISO 7730, PMV 2008 ver 1.0, Ingvar Holmer (http://wwwold.eat.lth.se/Forskning/Termisk/Termisk_HP/Klimatfiler/PMV-PPD.html).

The measured values were introduced in Java applet software for ISO 7730, PMV 2008 ver 1.0, Ingvar Holmer (http://wwwold.eat.lth.se/…) to calculate the percentage of PMV respectively PPD.

The predicted average vote (PMV) is an index that represents the average opinion of a large group of people which express their vote on thermal sensation in relation with the following scale with seven levels:

+3 very warm +2 warm	+1 lukewarm 0 neutral –1 cool	– 2 cold –3 very cold

The Predicted Percentage Dissatisfied (PPD). The PPD index provides information on thermal discomfort or dissatisfaction, estimating the percentage of people likely to have the sensation of too hot or too cold in a given environment.

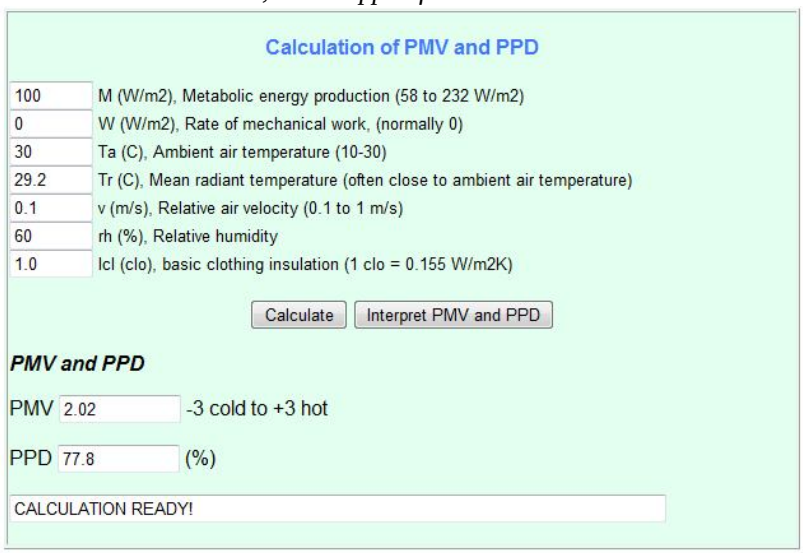
Considering Table 2, the classification of the value of *A*: V_{ar}< 0.2 m/s, the value of *A* is 0.5, was calculated the operative temperature of the air, as follows: t_0 = 29.6°C.

According to Table 6, the standard conditions recommended by EN 7730/2006 for the microclimate parameters, the operative temperature exceeds 2°C, the limit value recommended by EN 7730/2006.

Hence, it results that measures should be taken to improve the microclimate conditions in the laboratory. In this respect, the Developing of a Plan for the Prevention and Protection was recommended (Legea 319/2006; www.inspectmun.ro).

Table 6

PMV Calculation (Predicted Average Vote) and PPD (Predicted Percentage Dissatisfied) Using the Soft 2008 ver 1.0 Software, Ingvar Holmer, JAVA Applet for ISO 7730: 2006



7. Conclusions

Although apparently a lesser risk factor for occupational illness and hazard, the thermal environment becomes a current matter for office activities during the hot season, when the air temperature at workplaces exceeds the limits of thermal comfort.

The working environment consists of a room with 10 desks each, arranged in a building on the ground floor with windows facing southwest, without air conditioning, tinted windows fitted with blinds and tinted doors, in which only the laboratory activities are conducted.

The monitoring of microclimate parameters was performed in the laboratory which was not equipped with air conditioning; this being the most affected working area by the variations of temperature and humidity of the environment, requiring special measures for the protection of employees.

For the laboratory working areas in which the monitoring was carried out in June 2010, a PMV (predictable average vote) of 2.02 and a PPD of 77.82% were obtained, which shows a quite high percentage of employees' dissatisfaction as to the microclimate conditions from the working environment.

The percentage of PPD (*Predicted Percentage Dissatisfied*) and the PMV (predictable average vote) were also obtained following the monitoring of the microclimate parameters and the application of the software 2008 ver 1.0, Ingvar Holmer, JAVA applet for ISO 7730: 2006.

This shows the necessity to continue the implementation of the prevention measures from the prevention and protection plan and, with priority, the endowment of the physics laboratory with air conditioning equipment.

This study has led to the conclusion that in the physics laboratory, as long as the values recommended by the standards in force are not observed, the microclimate at the workplace influences on the workers and students' safety and health. To this end, a Prevention and Protection Plan was developed.

REFERENCES

Aris R. *et al*., *Boli respiratorii*. American Review, **148**, 1993, 1368-1369.

Jagjit S., *Impact of Indoor Air Pollution on Health, Comfort and Productivityof the Occupants*. Aerobiologia, **12**, 1996, 121-127.

* * * H.G. 1425 din 30.10.2006 pentru aprobarea Normelor metodologice de aplicare a Legii securitatii si sanatatii in munca 319/2006

* * * *Ambianțe calde. Estimarea stresului termic al omului in munca pe baza indicelui WBGT (temperatura umedă şi de globtermometru)*. SR EN 27243/1996.

* * * *Ambiante termice moderate. Determinarea analitică şi interpretarea confortului termic prin calculul indicilor PMV şi PPD şi specificarea criteriilor de confort termic local*. SR EN 7730/2006.

* * * *Ergonomia ambianțelor termice. Determinarea izolării termice şi a rezistenței la evaporare a unui ansamblu vestimentar*. SR EN 9920/2007.

* * * Legea 319/2006 *Legea securității şi sănătății în muncă*.

* * * www.inspectmun.ro.

* * * http://wwwold.eat.lth.se/Forskning/Termisk/Termisk_HP/Klimatfiler/PMV-PPD.html.

LOCURI DE MUNCĂ SIGURE ŞI SĂNĂTOASE ÎN UNITĂȚILE DE ÎNVĂȚĂMÂNT. MICROCLIMATUL ÎN MEDIUL DE MUNCĂ

(Rezumat)

Integrarea securității şi sănătății în muncă (SSM) în învățământ constituie, la nivel european, o componentă esențială a dezvoltării culturii de prevenire a riscurilor. Aceasta, acordă posibilitatea tuturor, de la profesori până la copii, de a învăța să trăiască şi să lucreze într-un mediu sigur si sănătos.

BULETINUL INSTITUTULUI POLITEHNIC DIN IAŞI
Publicat de
Universitatea Tehnică „Gheorghe Asachi” din Iaşi
Tomul LIX (LXIII), Fasc. 3, 2013
Secţia
ŞTIINŢA ŞI INGINERIA MATERIALELOR

THE INTEGRAL ESTIMATION METHODOLOGY OF MOTOR TRANSPORT ENTERPRISES' SUBSYSTEMS IN DETERMINING THE DEVELOPMENT STRATEGIES THROUGH TRANSFORMATION

BY

VICTOR BILICHENKO* and V.O. OGNEVIY

Vinnytsia National Technical University

Received: June 7, 2012
Accepted for publication: June 27, 2012

Abstract: The paper considers the issue of the determination of evaluation factors for subsystem efficiency, choosing the reference values, and the calculation of the relative index in determining the strategies of the development of the automobile transport enterprises through transformation.

Keywords: estimated features; reference values; strategy.

1. Introduction

In the market economy practice, there is being often used a method for comparison of the activity of an enterprises with competitors, since each of them is committed to be better by all aspects and more attractive for the final products' consumers. This method should be used in determining the strategies of motor transport enterprises through a transformation, because comparing their own performance factors with the indexes of companies-competitors can detect deviations and develop a strategy for transformational change.

Some elements of the reference comparison method have been developed in the USSR concerning the issues of comparative analysis of

*Correspondin author: *e-mail*: bilichenko_v@mail.r

product quality. This is reflected in the works of the leading experts on quality management E. Deming, F. Crosby, K. Ishikawa. Methodology for comparing acquired scientific features in the late 1980s, in the writings of R. Kemp, G. Watson, M. Zairi, H.J. Harrington, J. Shotmiller and others. Among modern scientists T.G. Golubeva, I.P. Danilov, D.V. Maslov, E. Mikhailova, N.G. Mikhailova, E. A. Bilokorovina should be mentioned [1].

However, nowadays, virtually no works are devoted to the definition of the reference indicators for modeling transformation processes in the motor transport sphere.

2. Problem Statement

In determining the most efficient development strategies for the motor transport enterprise from the positions of system approach, it is relevant to divide it into the following subsystems: structural, organizational, functional, managerial [2]. A search for strategies and the directions of enterprise functioning improving is suggested to conduct within each of the subsystems based on the comparison of the enterprise's subsystems performance factors, which are analyzed with standard parameters. This paper suggests to determine the reference values subsystems' estimated performance on the basis of analysis of really market functioning motor transport enterprises.

In determining these indicators it is suggested to use parametric methods of analysis and ranking score. These methods nowadays are becoming more common for comparing the performance of several enterprises.

Parametric analysis will be used to determine the set of parameters that characterize each of the subsystems.

Rating score shall be used to determine the numerical values of the reference indicators.

The objective of this paper is to develop integrated (complex) methods which evaluates the effectiveness of structural, functional, organizational and management subsystems and to determine the most effective strategy for motor transport enterprise's subsystems on its basis.

3. The Main Part

This method aims to prepare information for making the management decisions about the choice of the lagging subsystems and designing the developing strategies through the transformation of selected subsystems of ATE.

The basis of the suggested integral methodology is a solution of multi-objective problem, related to the procedure of formation of the generalized

function $F_i\ (a_{i1}, a_{i2}...a_{in})$, which is monotonically dependent on the criteria $a_{i1}, a_{i2}...a_{in}$.

This procedure is called the folding criteria method (additive optimization method).

A mathematical model of the additive optimization method looks as follows:

$$F_i(a_{ij}) = \sum_{j=1}^{J} \lambda_j \cdot a_{ij} \tag{1}$$

where: λ_j coefficients of importance, which quantitatively determine the importance of the *j*-th criterion in comparison with other criteria; a_{ij}- are the optimization criteria.

The economic meaning of this formula is that one of the a_{ij} criteria has weight factor that characterizes its importance. The system weight coefficients is compiled the way that $\sum_{j=1}^{J} \lambda_j = 1$.

To determine the a_{ij} criteria there shall be used the methods of complex multidimensional comparative estimates based on the method of distances which allows to takes into account the absolute values of subsystems' performance as well as their proximity or distance degree to standard subsystems' indicators (reference virtual enterprise).

The a_{ij} criteria are the relative magnitudes, *i.e.* the particles of subsystems' efficiency indicators appropriately attributed to the standard subsystems' efficiency indicators and are calculated by

$$a_{ij} = \frac{x_{ij}^{e}}{x_{ij}^{e}} \tag{2}$$

where: x_{ij}^{e} is the reported value of the *i*-th indicator in the *j*-th subsystem on the under research enterprise, x_{ij}^{e} is the reference value of the *i*-th indicator in the *j*-th subsystem, it may be maximal, minimal or normative.

The methodology of integral estimation of ATE subsystems provides for the consistent performance of the following stages:

The first stage is the formation of the estimated figures (performance indicators) set within all ATE subsystems and their calculation.

Основними вимогами до оціночних показників є:

The main requirements for the estimated figures (performance indicators) are:

a) unity, necessity and numerical limitations of indicators for particular subsystems;

b) the ability to aggregate, disaggregate and to be comparable;

c) definiteness, the ease of calculation and readily available information access about them;

d) overall system of indicators should provide for a complex characteristic of all the subsystems' aspects;

e) даний набір показників повинен бути найбільш вагомим як з точки зору автотранспортних підприємств так і з точки зору задоволення інтересів кінцевих споживачів транспортних послуг.

f) the given set of performance indicator has to be the most important from the point of view of motor transport enterprises, satisfying at the same time the final consumers' interests of transport services.

A set of performance indicators within all ATE subsystems is described in details in [3].

The second stage is the formation of matrix of output data for each Y_{ij} (i – number of indicator, j – number of subsystem) indicator of the j-th subsystem (structural, functional and organizational) which characterize them.

The matrix elements value depends on the rolling stock (k), company number (n), type parameter (s), subsystem number (j).

$$Y_{ij} = \begin{bmatrix} a_{11ij} & a_{12ij} & \dots & a_{1kij} \\ a_{21ij} & a_{22ij} & \dots & a_{2kij} \\ \dots & \dots & \dots & \dots \\ a_{n1ij} & a_{n2ij} & \dots & a_{nkij} \end{bmatrix}$$

These matrixes include different values of their original values, so the ATE subsystems must be normalized (reduced) to the standard interval in order to get their integral estimation.

In the third stage, each k-th column of the matrix (Y_{ij}) determines by the maximum (reference) item's value (max a_{nkij}). Then all the elements of the k-th columns are divided by the maximum value of the corresponding column. As a result we get the U_{ij} matrixes of the standardized coefficients

$$u_{nkij} = a_{nkij} / \max a_{nkij} \tag{3}$$

$$U_{ij} = \begin{bmatrix} u_{11ij} & u_{12ij} & \dots & u_{1kij} \\ u_{21ij} & u_{22ij} & \dots & u_{2kij} \\ \dots & \dots & \dots & \dots \\ u_{n1ij} & u_{n2ij} & \dots & u_{nkij} \end{bmatrix}$$

As a result of normalization of the performance indicators' set, their values range from 0 to 1.

It is worth noting that increasing the number of indicators inevitably raises the question of determining their significance.

Therefore, *the fourth stage,* in order to determine the *k*-th rolling stock's weighting coefficient for the particular motor transport enterprise which influences the proper *i*-th indicator of the *j*-th subsystem on the *n*-th enterprise we'll apply weight components matrix B_{ij}.

The determination of the B_{ij} matrix's coefficient is performed in the expert way, which algorithm is shown in Fig. 1.

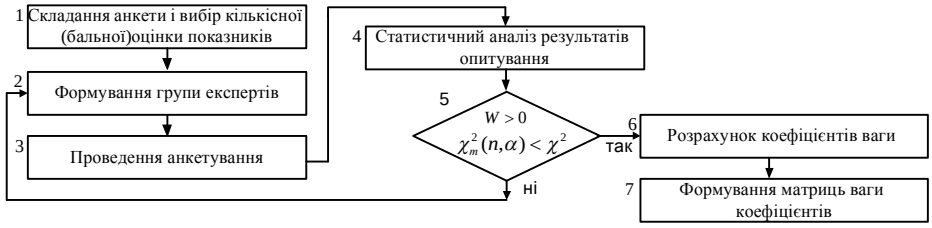


Fig. 1 – Expert estimation algorithm.

As the result of calculation of significance level coefficients generated by the suggested method, there shall be formed the weight coefficient matrix

$$B_{ij} = \begin{bmatrix} b_{11ij} & b_{12ij} & \dots & b_{1kij} \\ b_{21ij} & b_{22ij} & \dots & b_{2kij} \\ \dots & \dots & \dots & \dots \\ b_{n1ij} & b_{n2ij} & \dots & b_{nkij} \end{bmatrix}$$

At the fifth stage, taking into account the importance of *k*-th rolling stock group for the *n*-th motor transport enterprise, which affects each *i*-th indincator of the *j*-th subsystem we get matrix

$$P_{ij} = \begin{bmatrix} p_{11ij} & p_{12ij} & \cdots & p_{1kij} \\ p_{21ij} & p_{22ij} & \cdots & p_{2kij} \\ \cdots & \cdots & \cdots & \cdots \\ p_{n1ij} & p_{n2ij} & \cdots & p_{nkij} \end{bmatrix}.$$

The value of the P_{ij} matrix elements is obtained by multiplying the corresponding matrix elements U_{ij} on the corresponding matrix elements B_{ij} following the formula:

$$p_{nkij} = u_{nkij} b_{nkij}. \tag{4}$$

On the sixth stage. on the basis of the P_{ij} matrix we create a generalized values matrix $P_j^{узаг}$ of the *j*-th subsystems for *i*-th indicators on the *n*-th enterprises

$$P_j^{узаг} = \begin{bmatrix} p_{11j}^{y} & p_{12j}^{y} & \cdots & p_{1ij}^{y} \\ p_{21j}^{y} & p_{22j}^{y} & \cdots & p_{2ij}^{y} \\ \cdots & \cdots & \cdots & \cdots \\ p_{n1j}^{y} & p_{n2j}^{y} & \cdots & p_{nij}^{y} \end{bmatrix}.$$

The matrixes $P_j^{узаг}$ elements' p_{nij}^{y} values are defined as the sum of the *k*-th components of the motor transport enterprise, which affect the *i*-th indicator in the *j*-th subsystem

$$p_{nij}^{y} = \sum_{k=1}^{z} p_{nkij}, \tag{5}$$

where: *z* a number of the rolling stock groups.

When considering the management of transformation we start off with the this phase because *i*-th efficiency indexes of management do not depend on the weight of the *k*-th rolling stock group for the *n*-th motor company . For getting a matrix of administration transformation similar to the matrix $P_j^{узаг}$, first you must create a one of output data for managerial transformation , and then find the maximum value of all the items in each *i*-th column and divide the corresponding column by their respective maximum values. As a result, we obtain the transformation matrix $P_j^{узаг}$ for management transformation, that leads to the new notion of the *j*-th subsystem being understood as structural, functional , organizational and managerial .

On the seventh stage, there must be used the matrix of the indicators weight V_j, to determine the effect of each i-th parameter on the corresponding *j*-th subsystem to apply weight matrix indices.

Determination of matrix coefficient V_j is carried out in the expert way. The algorithm of undertaking the expert evaluation is similar to the performed one at the fourth stage.

Consequently, we can built matrix coefficients of weight V_j, after making the calculations following the mentioned-above method

$$V_j = \begin{bmatrix} v_{11j} & v_{12j} & \dots & v_{1ij} \\ v_{21j} & v_{22j} & \dots & v_{2ij} \\ \dots & \dots & \dots & \dots \\ v_{n1j} & v_{n2j} & \dots & v_{nij} \end{bmatrix}$$

The eighth stage is to build the matrix of $W_{рез}$ results considering the value of the i-th index for estimating the j-th subsystem;

$$W_{рез} = \begin{bmatrix} w_{11}^{рез} & w_{12}^{рез} & \dots & w_{1j}^{рез} \\ w_{21}^{рез} & w_{22}^{рез} & \dots & w_{2j}^{рез} \\ \dots & \dots & \dots & \dots \\ w_{n1}^{рез} & w_{n2}^{рез} & \dots & w_{nj}^{рез} \end{bmatrix}$$

The value of elements $w_{nj}^{рез}$ in $W_{рез}$ matrix are found as a sum of the *i*-th indexes regarding to the *j*-th subsystem for *n*-th enterprise

$$w_{nj}^{рез} = \sum_{i=1}^{d} (p_{nij}^{y} \cdot v_{ij}), \quad (6)$$

where d - a number of the characterizing indexes.

Дану матрицю значень $W_{рез}$ можна представити у вигляді таблиці 1

The matrix of $W_{рез}$ values may be presented as Table 1

Table 1

Integral Indexes of Subsystems' Efficiency

Enterprise	Structural	Functional	Organization	Managerial
1	$w_{11}^{рез}$	$w_{12}^{рез}$	$w_{13}^{рез}$	$w_{14}^{рез}$
…	…	…	…	…
n	$w_{n1}^{рез}$	$w_{n2}^{рез}$	$w_{n3}^{рез}$	$w_{nj}^{рез}$

Relative integral indexes of subsystems efficiency are calculated as follows:

$$W_{\text{від.j}} = \frac{W_{\text{досл. j}}^{\text{рез}}}{W_{\max j}^{\text{рез}}} \quad (7)$$

where: $W_{\text{досл. j}}^{\text{рез}}$ – the integral index of the j-th subsystem efficiency relating to the under research enterprise; $W_{\max j}^{\text{рез}}$ – the maximum value of the integrated index efficiency in the j-th subsystem among the competing users.

Let's assign such values as: structural $S_{ei\delta}$, functional $F_{ei\delta}$, organizational $Q_{ei\delta}$, managerial $Y_{ei\delta}$, to outline the calculated values of the relative integrated indexes with regard to subsystems efficiency .

This technique allows to determine how each subsystem of the researched enterprise differs from the similar subsystems examining the competing users. The closer the calculated value of the relative integrated efficiency indicator to 1, the better the state of the researched ATE subsystem in comparison with competing users subsystems and vice versa.

For easy and fast assessment of the subsystems it is necessary to develop an assessment scale:

$0.7 < W_{ei\delta.j} < 1$ – a good state of the subsystem and if the external environment is stable, the company then will not require transformation changes in this direction;

$0.35 < W_{ei\delta.j} < 0.7$ – an average state of the subsystem – it is necessary to conduct transformation changes;

$0 < W_{ei\delta.j} < 0.35$ – a poor state of the subsystem that hereby requires immediate responses.

For the verification of the developed method, there had been selected a real public company "Vinnitsa Transport Enterprise 10554" as the object of the research

The main activity of the public company "Vinnitsa Transport Enterprise 10,554" is to render services for freight transportation throughout the city, long-distance routes and international goods transportation.

The main competitors a public company "Vinnitsa ATE 10554" in the transportation of goods are: including "Trans Nazareth" Limited Liability Company , private enterprise "Berkut-trans", Vinnitsa ATE," "Trans - Legion Ukraine", Private enterprise " Ukrtrans Vinnytsia"".

Software is used [4] to speed up the calculation while determining the lagging behind subsystems by the method of integral evaluation.

The results of the computer simulation of structural, functional, organizational and management subsystems efficiency are shown in Table 2.

Table 2

Integral Indicators of Subsystems Efficiency on Auto Transport Enterprises

Enterpise / Indicator	Public company“ Vinnitsa ATP 10554”	“Trans Nazareth” Llc	Private enterprise “Berkut-trans”	Public company “Vinnitsa ATP 0161”	“Trans-Legion kraine” Llc	Private enterprise “ Ukrtrans Vinnytsia ”
1	2	3	4	5	6	7
The efficiency of structural subsystem $S_{\text{вид}}$	0.493	0.470	0.465	0.428	0.543	**0.878**
, $F_{\text{вид}}$ The efficiency of functional subsystem , $F_{\text{вид}}$	0.627	0.850	0.847	0.755	**0.949**	0.698
The efficiency of organizational subsystem $Q_{\text{вид}}$	0.691	0.779	0.789	**0.996**	0.716	0.896
The efficiency of administrational subsystem $Y_{\text{вид}}$	0.324	0.185	**0.359**	0.176	0.227	0.357

The reference value concerning the integrated indicators of subsystems efficiency are identified in Table with a black type.

Relative integrated indexes of the studied enterprise subsystems performance in comparison with the corresponding reference values equal to $S_{\text{вид}} \approx 0{,}562$, $F_{\text{â³ä}} \approx 0{,}661$, $Q_{\text{вид}} \approx 0{,}694$, $Y_{\text{вид}} \approx 0{,}903$ respectively.

Analyzing the calculated values , we make a conclusion that the structural , functional and organizational subsystem of the public company" Vinnitsa Auto transport Enterprise 10554 " needs transformation changes, because their corresponding integrated indices of efficiency are of smaller value than 0.7. According to the management subsystem, its relative integral index of efficiency is of higher value than 0.7 and it does not require the conduction of any transformation changes under the condition of stability.

4. Conclusions

Thus, there was put forward the method of multidimensional comparative analysis taking into account the weight of the indicator to determine the estimated indexes of subsystems efficiency , the selection of reference values and calculation of ratios while determining the highway transportation enterprises development strategies through the transformation in the working process .

Distinctive features of the integrated assessment subsystems technique are:

a) comprehensive assessment of several subsystems of a motor company;

b) the use of a wide range of indicators to measure ATE subsystems;

c) the use of expert methods;

d) lack of connection between the calculated indexes and with standard (average) criteria;

e) the possibility of building the ATE rankings on the basis of integrated assessment subsystems result;

f) the possibility of adjusting a set of indicators;

g) the possibility of considering the integrated assessment dynamics within one ATE. This technique does not depend on the units of measurement and their values.

REFERENCES

E.A. Belokorovyn. Reference comparison and adaptation of better business practice as a method of improving small enterprises productivity.Science specials. 08.00.05 - "Economy and Management of national economy (economy, organization and enterprise ,sector, complexes management: innovation and investing activity management)E.A. Belokorovyn - Moscow – 2006

Volkov V.P. Integrated evaluation of internal environment in shaping motor business transformation strategies / Volkov V.P., Bilichenko V.V., Ogneviy V.O. / Vestnik Kharkiv National Highway Transportation University . Zhutomir-2010. - № 49. - S. 57-61.

Bilichenko V.V. Computer program " Determining the estimated subsystems efficiency indicators of highway transportation enterprises, selecting the reference values and calculating relative ratios" / Bilichenko V.V., Ogneviy V.O. / / Certificate of copyright registration on a work number 37401 . - Kyiv: MONY Department of Intellectual Property. - Date of Registration: 16.03.2011.

Project Management [Textbook] / Mazur I. I., Shapiro V.D., and N.G. Olderohhe N.G., under general. edit. Mazur I.I.. - [2nd ed.] - M.: Omega-L, 2004. -664 P. - ISBN 5-98119-096-5.

METODOLOGIA DE ESTIMARE INTERGRALĂ A SUBSISTEMELOR UNEI ÎNTREPRINDERI DE TRANSPORT ÎN DETERMINAREA STRATEGIILOR DE DEZVOLTARE PRIN TRANSFORMARE

(Rezumat)

Se tratează determinarea factorilor de evaluare a eficienţei subsistemelor, alegând valorile de referinţă şi calculul indicelui relativ în determinarea strategiilor dezvoltării întreprinderilor de tresport auto prin transformare.

BULETINUL INSTITUTULUI POLITEHNIC DIN IAŞI
Publicat de
Universitatea Tehnică „Gheorghe Asachi” din Iaşi
Tomul LIX (LXIII), Fasc. 3, 2013
Secţia
ŞTIINŢA ŞI INGINERIA MATERIALELOR

PRODUCTION OF FLAKY GRAPHITE CAST IRON BY INOCULATION

BY

VASILE COJOCARU FILIPIUC*

“Gheorghe Asachi” Technical University of Iaşi
Faculty of Material Science and Engineering

Received: June 3, 2012
Accepted for publication: June 21, 2012

Abstract: The inoculating agents must contain highly graphitizing chemical elements, such as silicon, for example. The production of flaky graphite cast iron by inoculation actually means the inoculation of the cast iron, i.e. the alteration of the primary crystallization conditions by the insertion of an inoculating agent in the liquid iron. The interfacial surface tension between the metallic matrix and the inoculating agent drops is higher when the drops are lamella-shaped than when they are compacted and coral-like.

Keywords: flaky graphite; silicon content; FeSi75.

1. Introduction

Flaky graphite has a shape that is achieved by its morphological growth in a liquid metallic matrix that cools according to the stable Fe-C binary system. The metallic matrix – liquid iron – has an adequate chemical composition able to determine the cooling according to the stable Fe-C system. An unalloyed cast iron mainly has higher carbon and silicon contents, and lower manganese contents, since it is well known the fact that manganese is a highly anti-graphitizing element, while carbon and silicon are highly graphitizing elements (silicon more than carbon).

* *e-mail*: cojocaru52@yahoo.com

The production of flaky graphite cast iron by inoculation actually means the inoculation of the cast iron, *i.e.* the alteration of the primary crystallization conditions by the insertion of an inoculating agent in the liquid iron.

The inoculating agent inserted in the liquid iron causes the creation of a new phase in the iron.

The metallic matrix is an iron that crystallizes in the metastable system, meaning that it is a white cast iron. There are cases when the metallic matrix may crystallize as a mottled cast iron.

If the cast iron is unalloyed, the crystallization in the metastable system occurs if the metallic matrix has less carbon (the carbon saturation degree is 0.70…0.85) and silicon, and more manganese. The white iron, the carbon saturation degree of which is higher than 1, is also inoculated.

Fig. 1 shows the drawing of a metallic system made up of phases 1 and 2, where phase 2 is artificially created.

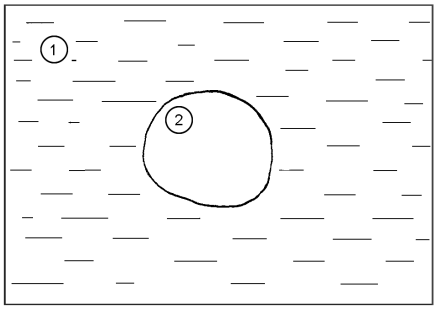


Fig. 1 – Drawing of a metallic system made up of two phases. 1 – liquid metallic matrix; 2 – new phase.

The inoculating agent must trigger the creation of a phase (phase 2) in the metallic matrix (phase 1).

Phase 2 must have a flaky shape.

This flaky shape may only be ensured by inoculating agents found in the liquid state at the inoculation temperature.

The inoculating agents must contain highly graphitizing chemical elements, such as silicon, for example.

The metallic matrix has little silicon, which, in practice, depends on the thickness of the casting walls (Sofroni & Ștefănescu, 1971) and on the amounts of other chemical elements found in the metallic matrix. For instance, Table 1 shows the relation between the average wall thickness and the silicon content in the metallic matrix of a cast iron that contains 3.0-3.3%C, 0.6…0.9%Mn and 0.4…0.8%P.

For instance, an iron subjected to inoculation contains 2.82% C, 1.35%Si, 0.77% Mn, 0.088% P, 0.039% S and Fe for the rest, while a cast iron

after inoculation contains maximum 3.5% C, 1.5…1.85% Si, 0.8…1.1% Mn, maximum 0.25% P, maximum 0.1%S and Fe for the rest.

Table 1
Wall Thickness-Silicon Content Correlation in the Cast Iron Containing 3.0-3.3%C, 0.6…0.9%Mn and 0.4-0.8%P

Average wall thickness, [mm]	Silicon content in the cast iron, [%]
10	2.0…2.1
20	1.8
30	1.6…1.7
50	1.4…1.5
75	1.3

The silicon element increases carbon activity significantly and is found in the chemical composition of grey cast iron as a representative element designed to ensure, just like carbon, the absence from the structure of free cementite. Therefore, in practice, it should be present in the inoculating agent in large amounts, namely 30% to 75%.

It is also recommended that silicon be accompanied by iron in the inoculating agent, also in large amounts, in order to increase the density of the inoculating agent drops and, hence, to reduce the inoculating agent losses in the metallic bath.

Silicon in the inoculating agent diffuses from the inoculating agent into the metallic matrix due to the tendency to chemical equilibrium. There is little silicon in the metallic matrix that solidifies in the Fe-C metastable system, and this is the reason why the silicon activity gradient between the metallic matrix and the inoculating agent drops is higher than that of the metallic matrix that is inoculated in order to produce graphite nodules. This way, the silicon particles diffuse at high rates from the inoculating agent into the metallic matrix and they gather around the drops where they increase carbon activity a lot and hence precipitate carbon particle diffusion from the metallic matrix towards the inoculating agent drops.

If the inoculating agent contained only iron and silicon, such as, for instance, the FeSi75 ferroalloy, silicon would dissolve in the metallic matrix and only iron particles would remain in the drops, which would make the density of the drops higher than the density of the metallic matrix. In such case, the mechanism of formation of the crystalline body of graphite would be that one as the crystalline body thus formed would dissolve within a short time.

In fact, the amount of silicon present in the inoculating agent does not entirely diffuse in the metallic matrix, since carbon activity reaches 1 due to the carbon particles gathering around the drops and due to the decrease of the temperature of the metallic matrix, and the graphite nuclei thus formed start to grow as single crystals inside the drops.

Anyhow, if the inoculating agent contained only iron and silicon, the graphite produced (supposing it was produced) would dissolve very quickly in the metallic matrix, that is there would be no inoculation.

Further to the inoculation process, the silicon content in the iron increases by 0.2…0.5% due to the inoculating agent.

In addition to silicon and iron, the inoculating agent should also contain inoculating elements and surface-active elements able to give their lamella shape to the drops.

Just like for compacted graphite, the factor ensuring the lamella shape of the drops is the interfacial surface tension between the metallic matrix and the inoculating agent drops, σ_{12}.

The σ_{12} interfacial surface tension is higher when the drops are lamella-shaped than when they are compacted and coral-like.

The volume taken up by the lamella-shaped drops is the smallest of the volumes of all the drop shapes.

There are essential differences between the graphite lamellae produced by inoculation and the graphite lamellae produced morphologically, in non-inoculated cast irons.

In principle, the flaky graphite produced by inoculation is shorter, thinner, has rounded edges, grows in a liquid metallic matrix without requiring the solidification of the metallic matrix, is outside the thermodynamic equilibrium after formation, is a crystalline body of graphite, *i.e.* is made up of several graphite single crystals, is not interconnected, etc.

In principle, the shape of the flaky graphite produced by morphological growth depends on the carbon content of the iron, on the temperature at which the graphite nuclei are formed and on the temperature range within which the latter grow, on the cooling rate, on the chemical composition of the iron, etc. Flaky graphite may thus be interconnected in the eutectic cells of all iron categories (hypoeutectic, eutectic and hypereutectic); however, isolated graphite lamellae may also be formed during the eutectic transformation, which grow by the formation of graphite nuclei in the eutectic liquid due to the solidification front that advances around the middle of the eutectic cells (Laplanche, 1975). Morphological flaky graphite consists of single crystals shaped as lamellae in plane and small leaves in space. In hypereutectic cast irons, the primary morphological graphite lamellae are isolated, and they do not depend on a solidification front since they represent themselves the solid part of the solidification range – they are long and thick.

The poor mechanical resistance characteristics and, most importantly, the absence of the plasticity features rely on the existence of interconnected graphite (Apostolescu, 1982), and on the phenomenon of marked straining caused by the sharp edges and rough appearance (they are long and thick) of the graphite lamellae.

Fig. 2 is the plane representation of two graphite lamellae, the first, (*a*), produced without inoculation and the second, (*b*), produced by inoculation.

The lamella in Fig. 2 *a*, may be a primary graphite inclusion coming from a hypereutectic cast iron or a eutectic graphite inclusion formed in areas that are more remote from the middle of the eutectic cells, in all the cast iron categories.

The flaky graphite produced by inoculation is the compacted graphite with the smallest surface.

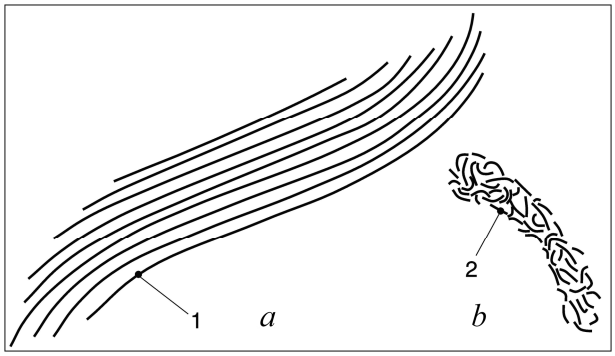


Fig. 2 – Drawing of two graphite lamellae, in plane, produced without inoculation – (a) – and with inoculation – (b). 1 – layers of carbon atoms; 2 – graphite single crystals.

Since the drops cannot have sharp prominences, the flaky graphite produced by inoculation does not create marked tension states in the castings. The term flaky graphite cast iron with rounded edges is also found in industrial practice. Since the flaky graphite produced by inoculation is not interconnected, the degree of isolation of the metallic matrix is very low. Concretely speaking, these two specific aspects, together with the isolated and individual location of the graphite lamellae produced by inoculation in the metallic matrix and by the fine appearance of the graphite lamellae produced by inoculation, determine mechanical resistance features in the flaky graphite cast iron produced by inoculation that are superior to the flaky graphite cast iron produced without inoculation.

Silicon and iron must be accompanied by surface-active elements that gather less at the metallic matrix-inoculating agent drop interface, such as Ca (Ferri, 1967), Ce^{4+}, La, Na, Sr (Dawson,1966, 1967), Ba, K, Rb, Zr and Jb (reference (Ripoşan & Sofroni, 1984) also includes Eu, Np, Hf, Pa, Pu and Ac).

Silicon may be replaced by copper in the inoculating agent, as copper is highly graphitizing, meaning that one percent of copper decreases carbon solubility in liquid iron by 0.2%. Copper dissolves in liquid iron.

Aluminum may also play the silicon's role in the inoculating agent, as it is highly graphitizing and it increases carbon activity.

Small amount of highly surface-active elements, such as Al, Ti, Sn, etc., accompany the highly graphitizing elements (Si, Cu, Al, etc.) in the inoculating agents. These chemical elements are designed to decrease the σ_{12} interfacial surface tension, and, most importantly, to be adsorbed on the flaky graphite in order to delay the dissolution of the graphite lamellae in the metallic matrix. Since the flaky graphite produced by inoculation has the smallest surface, the inoculating agent drops have the smallest surface of all the other categories of drops, the amount of inoculating and surface-active elements that need to be adsorbed on the graphite lamellae is also smaller. The phenomenon of dissolution of the graphite lamellae produced by inoculation is said to be less pronounced than the same phenomenon that occurs in the other categories of inoculated irons, which is due to the fact that the graphite lamellae are entirely "covered" by particles of inoculating elements and surface-active elements, since they are smaller. The amount of inoculating elements and surface-active elements found in the inoculating agent, which are strongly adsorbed on flaky graphite, has the same size grade as nodular and compacted graphite, for instance.

The reactive character of the inoculating and surface-active elements adsorbed on flaky graphite determines their interaction with the chemical elements in the metallic matrix, for which they have very high chemical affinity, and, hence, their desorption from the flaky graphite surface, which accelerates the dissolution of the lamellae produced by inoculation in the metallic matrix; the lamellae produced by inoculation in the metallic matrix at temperatures higher than the liquidus line temperature are outside the thermodynamic equilibrium.

The inoculating agent inserted in the irons with a saturation degree higher than 0.77 should contain a high amount of carbon appearing as graphite. The grained graphite is mixed with the inoculating agent grains. The carbon in the graphite increases the carbon activity in the iron more than the other highly graphitizing chemical elements, by locally increasing the molar fraction and also by increasing the carbon activity coefficient.

In principle, just like for the other categories of inoculated iron, the flaky graphite inclusions achieved by inoculation have a primary austenite halo, after the eutectic transformation.

2. Conclusions

1. The inoculating agents must contain highly graphitizing chemical elements (Si, Cu, etc.);

2. The silicon element increases carbon activity significantly and is found in the chemical composition of grey cast iron;

3. In practice, the silicon content should be present in the inoculating agent in large amounts, namely 30% to 75%;

4. The volume taken up by the lamella – shaped drops is the smallest of the volumes of all the drop shapes;

5. In principle, the flaky graphite inclusions achieved by inoculation have a primary austenite halo, after eutectic transformation.

REFERENCES

Apostolescu R., *Cristalografie. Mineralogie*. Edit. Didactică şi Pedagogică, Bucureşti, 1982.

Dawson J.V., *Efectul stimulator al stronţiului din ferosiliciu şi din alţi inoculanţi pe bază de siliciu*. Modern Casting, Mai.1966, 171.

Dawson J.V., *Recent research on the inoculation of cast iron*. The British Foundryman, Apr. 1967.

Ferri R., *Etude sur un inoculant synergetique pour fontes mécaniques à haute resistence*. 34-e Congrés International de Fonderie, Paris, Oct. 1967.

Laplanche H., *Les fontes et leurs traitements thermiques*. Pyc-Edition-Desforges, Paris, 1975.

Ripoşan I., Sofroni L., *Fonta cu grafit vermicular*. Edit. Tehnică, Bucureşti, 1984.

Sofroni L., Ştefănescu D.M., *Fonte modificate cu proprietăţi superioare*. Edit. Tehnică, Bucureşti, 1971.

PRODUCEREA DE FONTĂ CU GRAFIT LAMELAR PRIN MODIFICARE

(Rezumat)

Modificatorii trebuie să conţină elemente chimice grafitizante în cantitate mare, cum ar fi, de exemplu, siliciu. Producerea fontei cu grafit lamelar prin modificare, înseamnă modificarea fontei, adică schimbarea condiţiilor de cristalizare primară prin introducerea de modificator în fonta lichidă. Tensiunea interfazică dintre matricea metalică şi picăturile de modificator are valori mai mari în cazul geometriei de lamelă a picăturilor decât în cazul geometriilor compactizată şi coral.

BULETINUL INSTITUTULUI POLITEHNIC DIN IAŞI
Publicat de
Universitatea Tehnică „Gheorghe Asachi” din Iaşi
Tomul LIX (LXIII), Fasc. 3, 2013
Secţia
ŞTIINŢA ŞI INGINERIA MATERIALELOR

PARTICIPATORY ASSESSMENT OF RISK – ESSENTIAL BUSINESS EFFICIENCY

BY

DRAGOŞ-ALIN LĂPUŞNEANU[1,*] and VIRGIL LĂPUŞNEANU[2]

[1]"Gheorghe Asachi" Technical University of Iaşi
Faculty of Material Science and Engineering,
[2] ITM Neamț

Received: June 12, 2013
Accepted for publication: June 27, 2013

Abstract: The paper refers to the core of business efficiency witch is the participatory approach to risk assessment through the participation of the employer and/or his representative and the workers and/or their representatives.

Keywords: health and security; risk evaluation; workers' experience; participatory assessment; involvment of workers; business efficiency.

1. Introduction

Risk assessment is the foundation of a successful management of safety and health at work and can only be considered as key action to reducing accidents and illnesses.

Ensuring a high level of safety and health is the most important objective of the policy for preventing of employers to preserve the life and health of workers.

Risk assessment requires a strong involvement of employers and workers, and is the only way to to have secure and healthy jobs.

[*]Corresponding author: *e-mail*: dragosh8@yahoo.com

2. Risk Assessment

2.1. The Purpose of Risk Assessment

The primary goal of occupational risk assessment is to protect the health and safety of workers. Risk assessment helps to minimize the possibility of injury for workers or the negative impact on the environment as a result of work-related activities. A proper risk assessment includes, among other things, ensuring that all relevant risks are taken into account (not only immediate or obvious).

Also, the purposes of a risk assessment is to allow employers to take preventive measures to protect the safety and health of their workers.

2.2. Workers' Rights

Workers and/or their representatives have the following rights/ obligations:

a) to be consulted on the organization of risk assessment and the designation of the persons performing this task;

b) to participate in the risk assessment;

c) to warn the workers designated with the activities of protection and prevention or employers about the risks observed;

d) to report any change in the workplace ;

e) to be informed of the risks regarding their safety and health and the measures required to eliminate or reduce them;

f) to be involved in the process of deciding on preventive and protective measures to be implemented;

g) to require employers to adopt appropriate preventive measures;

h) to be trained/to receive instructions on the prevention measures that will be implemented;

i) to protect, as far as possible, their safety and health and other people affected by their actions in accordance with training and instructions of the employer.

2.3. Participatory Assessment of Risk

Participation is a word used often today. Participation means different things in different contexts. For work in an enterprise, participation means that all staff participate in risk assessment and decision-making on prevention, to eliminate/reduce them.

To organize a proper risk assessment, competent people should be elected. The number of people to be involved in the risk assessment depends on the company size and on the severity of the risks present in the establishment.

Participatory assessment of risk means that not only employers contribute and influence the decisions affecting the enterprise, but also the workers.

A risk assessment should not be carried out in isolation by the employer or the employer's representative. No matter how wise and experienced a boss is, he/she does not have as much experience as all of his/her employees.

Employers should involve employees or their representatives. Employee participation is not only a right but is an essential for the employer's management of health and safety in the workplace to become efficient and effective. Involvement of workers and their representatives with specific responsibility for the health and safety at work, that health and safety committees at work (CSSM), is not only recommended but is mandatory especially in the phaze of hazard identification.

Workers know best the dangerous situations at work stations, and CSSM and workers' representatives with responsibilities in health and safety at work are trained and aware of the dangers specific to the activities within the enterprise. It is important for workers to participate in the risk assessment process. In most cases, they know best the hazards associated with each job. Their experience should be used because risk assessment should be based on existing conditions.

2.4. Decision in Risk Assessment

The participatory risk assessment, managers still have the final responsibility for making decisions and to be accountable for them, and the workers are affected by those decisions. Therefore, workers and/or their representatives (trade union leaders and workers with specific responsibility for the health and safety at work) may be required to actively participate in the risk assessment to provide comments, suggestions and make recommendations to the executive process of decision analysis. For participation in decision making it is required good communication skills. The more open the channels of communication, the more workers will participate in decisions on risk assessment and implementation of preventive measures.

The workers must be informed of the conclusions of the assessment of risks and the preventive measures to be taken; and the consultation of the workers is an integral part of risk assessment. When decisions are made through active consultation with employees/workers' representatives with specific responsibility/union leaders, there is less suspicion of illegal and immoral decision-making under questionable circumstances. Participatory approaches usually means that decision-making is more transparent, and decisions tend to be better when they are based on a wider range of knowledge, information and experiences.

The CSSM is an organized framework where decisions are taken regarding:

a) prevention of occupational risks;

b) informing workers;

c) training of workers;

d) consultation of workers;

e) awareness of workers

f) ensuring the organization and the means to implement the necessary preventive measures.

The employer/management representative and CSSM must discuss and approve the annual plan of prevention and protection, its changes, periodic reports of the employer on safety and health at work and to pursue the implementation of the plan.

2.5. The Benefits of Participatory Assessment

The participation of workers and / or their representatives in the risk assessment can bring many benefits to the enterprise such as:

a) the formation of sustainable culture of safety and health at work;

b) the awareness of the hazards for the workers exposed in the workplaces;

c) the training of workers on safety and health at work;

d) maximizing worker productivity through increased worker loyalty and respect for the interests of the company;

e) workers feel useful and want and seek to show their achievements ;

f) workers feel respected and believes it is important what they do ;

g) workers feel that their opinion matters ;

h) increased confidence in workers - important factor of quality management;

i) increasing the leadership skill for the manager;

j) accept measures that will eventually be taken;

k) awareness of the possibility of risks other than those identified.

2.6. Ways to Channel the Participation

Generating a strategy for increasing participatory risk assessment.

Form a team composed of the employer or his representative, workers, workers designated for protection and prevention activities, managers, workers' representatives with specific responsibility for the health and safety at work, occupational physician and experts.

If you have already established a CSSM, it must be consulted on the composition of the team.

Training the team to understand risk assessment and their role in making this assessment.

Implementation of a program for employee participation.

Setting the communication mode by finding ways to talk to workers at every opportunity in which decisions are taken in the risk assessment.

2.7. Costs Of Participation

However, to achieve participatory risk assessment there are some costs:

a) it takes longer to analize and to determine the results results;

b) when workers support a particular decision, but the regulations, budget and the employer does not allow that decision, the workers may be disappointed and may reduce their efforts;

c) the employer must invest extra time and effort to reach a decision - with the participation of workers;

d) disagreements may affect work.

3. Conclusions

Although there are some difficulties in adopting a participatory approach to risk assessment, many benefits outweigh the costs. If implemented properly, it can improve security and health at work and can better the performance of the businesses in general. In this context, the most attractive and competitive companies in the market are the ones with healthy working conditions. It is obvious that participatory risk assessment and the adoption of the most appropriate measures of prevention and protection lead to higher levels of safety and health of businesses. Safety and health at work is an essential element of business efficiency because:

a) demonstrates that the company is socially responsible;

b) protects and enhances brand image and brand value;

c) helps to maximize productivity of workers;

d) improves employee loyalty to the company;

e) building a healthier and more skilled workforce;

f) reduce costs and downtime of business;

g) allow businesses to meet customer expectations for safety and health at work;

h) encourage the workforce to remain active longer;

i) motivates the commitment of workers;

j) enhances investor confidence;

k) leads to lower costs of occupational accidents and diseases;

l) retain old customers and gain new customers;

m) maintain the brand and a good reputation

REFERENCES

* * * *Legea securităţii şi sănătăţi în muncă* nr. *319*/2006.
* * * http://osha.europa.eu.
* * * http://inspectiamuncii.ro.

EVALUAREA PARTICIPATIVĂ A RISCURILOR – ELEMENT ESENŢIAL AL EFICIENŢEI UNEI AFACERI

(Rezumat)

Se face referire la elementul esenţial al eficienţei unei afaceri care constă în abordarea participativă a evaluării riscurilor prin participarea lângă angajator/reprezentantul acestuia a lucrătorilor şi/sau reprezentaţii lor.