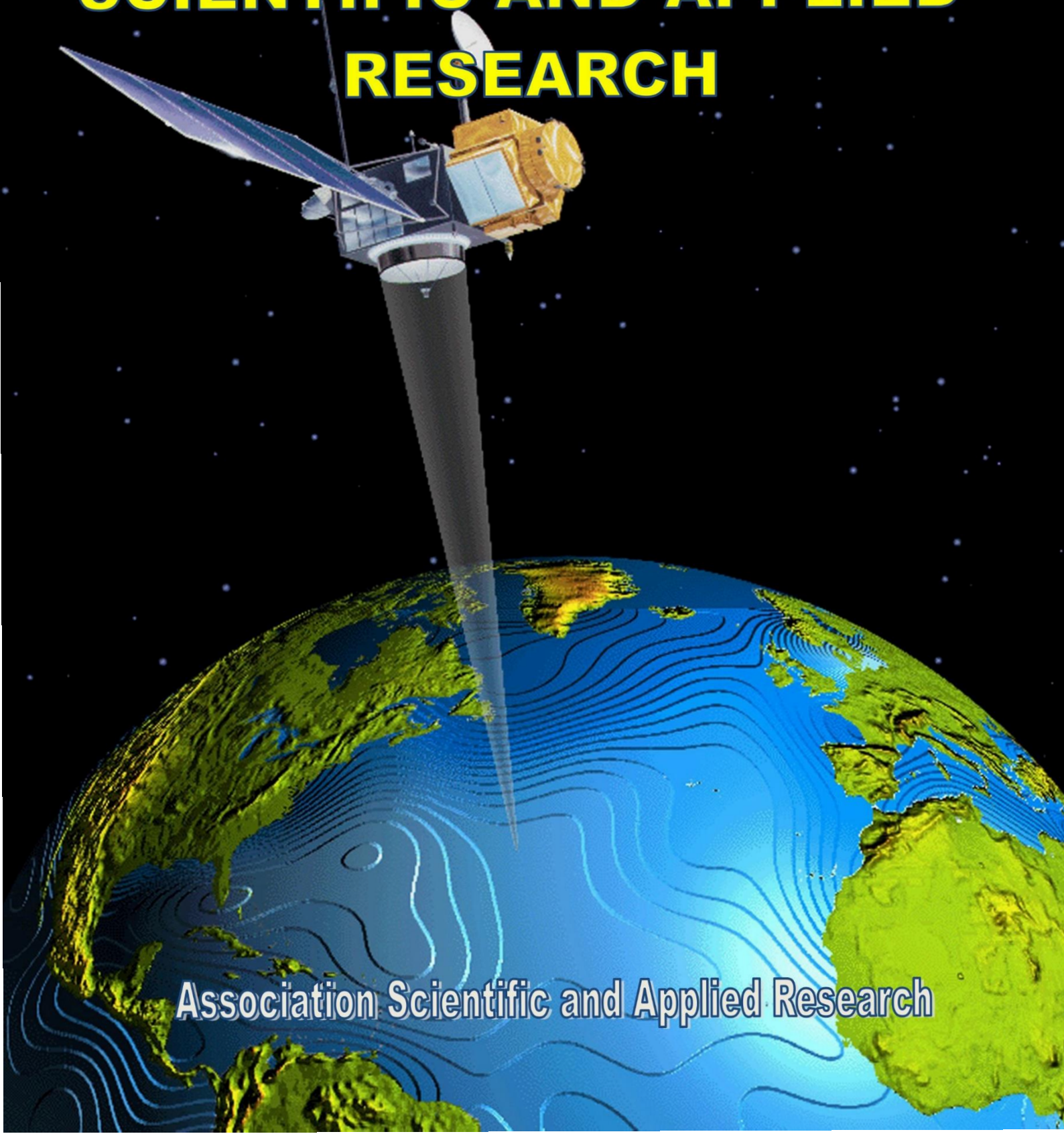


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RESEARCH ON THE BACKGROUND INFLUENCE ON THE RESOLUTION AND DEFINITION OF THE VARIATIONS OF THE BACKGROUND LUMINANCE OF ELECTRONIC-OPTIC CONVERTERS

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ABSTRACT: *The current research refers to electronic-optical devices working in conditions of different levels of background luminance. The aim of the research is to define the influence of the background luminance upon the resolution of different types of electronic-optical converters. The aim is achieved by experimental research and dispersion analysis when mathematically processing the received data. A possibility to select the converters has been created according to the direct aspect of their usage. Four types of electronic-optical converters are used for official use and this is the reason why their technical characteristics are not presented.*

KEY WORDS: *visual observation, electronic-optical converters, distant objects, resolution, background luminance*

The research is about electronic-optical devices which work at different background luminance and which are used in machines for the defense and military technics [1], as well as in aerospace research [2,3,4].

The task is to choose an optimum electronic-optical converter (EOC) for identification of distant objects and for this reason it is necessary to define what influence has the background luminance over the resolution of the converters.

The resolution of four different types of EOC (for official use) at three levels of background luminance at contrast equal to 0,5. Devices for objective evaluation of the characteristics of electronic-optical converters have been used [5].

At level I:

$N_1(B_1)$ – maximum resolution of EOC at optimum luminance for observation of the test object;

At level II:

$N_2(B_2)$ – normal resolution of EOC at background luminance 2,6 cd/m²;

At level III:

$N_3(B_3)$ – normal resolution of EOC at background luminance 0,024 cd/m²;

The registered values for $N_1(B_1)$, $N_2(B_2)$ and $N_3(B_3)$ for the respective types of EOCs are presented in Table 1.

Table 1. Values of $N_1(B_1)$, $N_2(B_2)$ and $N_3(B_3)$ for different types of EOC

EOC N	EOC 1				2				EOC 3				EOC 4				$\overline{X}_{0e}$
	j			$\overline{X}_{1e}$	j			$\overline{X}_{2e}$	j			$\overline{X}_{3e}$	j			$\overline{X}_{4e}$	
	I	II	III		I	II	III		I	II	III		I	II	III		
$N_1(B_1)$	35	33	34	34	36	37	38	37	27	28	29	28	29	30	28	29	32
$N_2(B_2)$	32	30	31	31	33	33	33	33	25	23	24	24	25	27	26	26	28,5
$N_3(B_3)$	25	27	26	26	28	29	30	29	22	23	21	22	23	23	23	23	28
$\overline{X}_{ie}$	33,33				33,36				24,66				26,0				28,5

When the calculated results are mathematically processed, a two factor dispersion analysis is used.

The basic equation of the dispersion analysis of two factors – the researched EOCs and the levels of the background luminance is: [6,7]

$$(1) \quad Q = Q_E + Q_B + Q_V + Q_R$$

where Q – sum of squares total;
 Q_E – sum of squares of EOCs;
 Q_B – sum of squares of background luminance;
 Q_V – sum of squares between the variants of interaction between the EOCs and the background luminance;
 Q_R – sufficient sum of the squares.

The number of degrees of freedom r of these sums of squares is respectively:

$$(2) \quad r = N - 1 = nkq - 1 = 3 \cdot 4 \cdot 3 - 1 = 35$$

where n – number of the experiments;
 k – number of the researched EOCs;

q – number of the researched background luminance;

$$(3) \quad \begin{aligned} r_E &= k - 1 = 4 - 1 = 3 \\ r_B &= q - 1 = 3 - 1 = 2 \\ r_V &= (k - 1)(q - 1) = 6 \\ r_R &= kq(n - 1) = 24 \end{aligned}$$

where r_E – degree of freedom of EOC;
 r_B – degree of freedom of the levels of background luminance;
 r_V – degree of freedom of the variants of interaction between EOC and the background luminance;
 r_R – degree of freedom of residual sum of squares.

Evaluation of the dispersion S is obtained when dividing the sums of the squares Q, Q_E, Q_B, Q_V and Q_R into the respective degrees of freedom r, r_E, r_B, r_V and r_R . The quotients are presented in Table 2.

Table 2. Values of the dispersion

Sum of squares	Degrees of freedom	Evaluation of the dispersion
$Q = \sum_{i=1}^k \sum_{l=1}^q \sum_{j=1}^n (\bar{x}_{ilj} - \bar{x})^2 = 1604,09$	$r = 35$	$S^2 = \frac{Q}{r} = 45,8$
$Q_E = nq \sum_{i=1}^k (\bar{x}_{io} - \bar{x})^2 = 638,37$	$r_E = 3$	$S_E^2 = \frac{Q_E}{r_E} = 212,8$
$Q_B = nk \sum_{l=1}^q (\bar{x}_{lo} - \bar{x})^2 = 147$	$r_B = 2$	$S_B^2 = \frac{Q_B}{r_B} = 73,5$
$Q_V = \sum_{i=1}^k \sum_{l=1}^q (\bar{x}_{ie} - \bar{x}_{io} - \bar{x}_{lo} + \bar{x})^2 = 798,72$	$r_V = 6$	$S_V^2 = \frac{Q_V}{r_V} = 133,12$
$Q_R = \sum_{i=1}^k \sum_{l=1}^q \sum_{j=1}^n (x_{ilj} - \bar{x}_{il})^2 = 20$	$r_R = 24$	$S_R^2 = \frac{Q_R}{r_R} = 0,83$

In order to check the validity of the null hypothesis H_0 for the different types of EOC and for the background luminance influence, the dispersion relations are calculated:

$$(4) \quad F' = \frac{S_E^2}{S^2} = 156,1$$

$$F'' = \frac{S_B^2}{S_R^2} = 88,5$$

$$F''' = \frac{S_E^2}{S_R} = 161,5$$

The table values of the dispersion relation F , (taken from Tables 5 and Table 6 [6]) are respectively 5% and 1% significance levels α at number of degrees of freedom $r_E = 3$, $r_B = 2$, $r_V = 6$ and $r_R = 24$ are:

for $\alpha = 0,05$	for $\alpha = 0,01$
$F'_T = \frac{r_E}{r_B} = 3,01$	$F'_T = 4,72$
$F''_T = \frac{r_B}{r_R} = 3,40$	$F''_T = 5,61$
$F'''_T = \frac{r_V}{r_R} = 2,51$	$F'''_T = 3,67$

Consequently the null hypothesis that the resolution of the different type of EOC is not influenced by the value of the background luminance cannot be taken as valid because $F' \gg F'_T, F'' \gg F''_T$ и $F''' \gg F'''_T$ for the two levels of significance, i.e. the influence of the background influences significantly the value of the resolution of the researched EOC.

Defining the numbers which characterize the change of the information signal depending on the dark current is performed in order to define the possibility to register weak signals. The mutual dependence of the information signal by the dark current is taken into account. It is known that when there is lack of information signal, the dark current is minimal. Consequently, there are variations of the dark current. Its identification is performed when we accept that the dark current is a random variable. The reason to accept this is the data from experimental measuring performed by devices for evaluation of the characteristics of EOC [5] and the data from the 100 measurements performed by ADC, DI and PO [9] when we use the dependence of dark current of this type:

$$(6) \quad i_{t_{cp}} = \sum_{i=1}^n i_{t_i} \frac{n_i}{N} = \sum_{i=1}^n i_{t_i} P_i^* = 2,34$$

where P_i^* – frequency of appearance of i_{t_i} values of the dark current;
 N – number of the measured values of the dark current.

The fixed in (6) value of the dark current is the average value from the measurements. And because every random variable has a basic characteristic its average value [7,10], so this characteristic will be a basic one for the dark current. If we interpret from a physical point of view, this means that all the possible values of the scintillations in the central zone of the EOC are grouped.

A characteristic of the random variable is the expected value. In this case it is described as:

$$(7) \quad M(I_t) = \sum_{i=1}^n i_{t_i} P_i = 2,3$$

where i_{t_i} – Possible values of the dark current;
 P_i – Probability of the possible values of the dark current to appear.

The received numbers of expected value, however close to the average value of the dark current, is enough to define fully its variations. In order to do this, we use another characteristics of the random variable – the dispersion $D(I)$.

If we describe it as an expected value:

$$(8) \quad D(I) = M(I_t^2) - M^2(I_t) = 0,218.$$

The dispersion defines the scattering of the possible values about the center.

Mean squared deviation σ_{i_t} allows us to compare the random values according to the level of their dispersion.

By the calculated values of $D(I)$ from formula (8) we define mean squared deviation:

$$(9) \quad \sigma_{i_t} = \sqrt{D(I_t)} = 0,466.$$

Consequently, expected value, dispersion and mean squared value can be used as numerical characteristics which characterize every random variable and which define the change of the information signal depending on the dark current.

The numerical values allow us to draw a graphics depicting the law for distribution of the dark current. For this purpose we use Lopunov Limit Theorem. [8].

So, for the probability density for normal distribution of the dark current i_t the formula is:

$$(10) \quad f(i_t) = \frac{1}{\sigma_{i_t} \sqrt{2n}} e^{-\frac{(i_t - m_{i_t})^2}{2\sigma_{i_t}^2}}$$

where m_{i_t} and σ_{i_t} are parameters of the normal distribution and $m_{i_t} = M(i_t)$ is the expected value and σ_{i_t} is mean squared deviation.

The distribution law is normal. This is evidence that the dark current is a random variable with normal distribution. Besides this, the maximum of the function is received at:

$$f(i_t)_{\max} = 0,865$$

The following conclusions can be drawn:

1. The data from the experiment prove the credibility of the defined numerical values which characterize the change of the information signal depending on the dark current at given background luminance.
2. The performed dispersion analysis proves that the background luminance influences at a different degree the resolution of the respective types of EOC. At lower level of background luminance the best results for visual observation of distant objects are registered by means of EOC-2 and EOC-1, and at observation at dusk – EOC-3, EOC-4 and EOC-1. Combining the type of EOC with the conditions of the conducting the experiment is basis for creating optimum conditions for discovery and identification of objects at different degrees of background influence, when predicting of the probability by means of the calculated resolution of the researched EOC.

REFERENCES:

- [1]. Getzov, P. Space, Ecology, security. New Bulgarian University, 2002, 211 p.
- [2]. Mardirossian, G. Aerospace Methods in the Ecology and Environmental Studies. Part I. Academic Publishing Marin Drinov, Sofia, 2003, 208 p.
- [3]. Stoyanov, S. Mathematical Model of Optical Tract of Optical-Electronic Device. Papers from Anniversary Scientific Session “100 Years Since the Brothers Write Flight”, Aviation Faculty of National Military University “V. Levski”, Dolna Mitropoliya, 2003.
- [4]. Eldering H. G. JOSA, 1998, vol. 31, N 12, p. 1211.

- [5]. Zhekov, Zh. Devices and Methods for Objective Evaluation of the Characteristics of Optical-Electronic Converters. Second National Conference of Optics and Laser Technics, Optics-84, 1984
- [6]. Davis, G. Simp. Photo Image Dev., London, 1992.
- [7]. Rangarian L. M., V. R. Katti, G.K. Bridge. Pure and Appl. Phys., 1994, N 2, p. 12.
- [8]. Korn G, T. Korn. Handbook of Mathematics for Scientific Workers and Engineers, Science, Moscow, 1977
- [9]. Stoychev, V., K. Valchev, Zh. Zhekov. Analogue-Digital Converter, Digital Indicator and Printing Output (ADC, DI and PO), Scientific Session, Military University, Shumen, 1985, p. 6
- [10]. Greene, J. Navigation, 2003, vol. 31, N 12, p. 1211.



USE OF ANALYTIC HIERARCHY PROCESS IN LOGISTICS DEMAND FORECASTING

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ABSTRACT: The report analyzes the possibility of using analytic hierarchy process in logistics demand forecasting. It proposes a method to estimate parameters of the individual values of the analysis.

KEY WORDS: logistics management, analytical hierarchy process, storage area.

I. Introduction

Demand forecasting plays an important role in today's integrated logistics system. It provides valuable information for several logistics activities including purchasing, inventory management, and transportation. To minimize the total logistics cost, an accurate and reliable forecasting approach should be developed and adopted. In real-world situations, both quantitative and qualitative factors affecting the demand should be taken into consideration simultaneously. Since analytical hierarchy process has emerged as the promising methodology for dealing with a wide variety of decision - making problems, this chapter presents an analytical hierarchy process - based approach to analyze the priority rankings of all relevant factors to formulate a forecasting mathematical equation.

II. Exposition

Logistics management is sophisticated because it involves numerous complicated activities including customer service, demand forecasting, distribution management, information maintenance, inventory management, materials handling, order processing, packaging, purchasing, reverse logistics, transportation, warehousing, and so on. It is undoubted that these activities are interrelated. For instance, reducing the inventory of finished products will reduce the inventory carrying costs and warehousing costs, but may lead to stock-out as a result of reduced levels of customer service. Because of this

relationship, logistics management can also be regarded as the administration of various activities in an integrated system [2].

Due to the presence of a wide variety of uncertainties in the realworld situations, however, the optimal inventory level is difficult to determine. One of these uncertainties is demand uncertainty, that is, the amount of finished products or services that customers will require at some point in the future is unknown. Demand forecasting, therefore, is a dominant attribute of the inventory management. Besides inventory management, demand forecasting provides valuable information for the purchasing and transportation problems, as illustrated in Figure 1. On the basis of forecasts, the decision-makers of the logistics companies can decide on the amount of raw materials to be purchased from the suppliers (i.e., the purchasing problem) to meet the production requirement, decide on the amount of work-in-process and finished products to be stored in the warehouses, and decide on the amount of finished products to be transported to the customers.

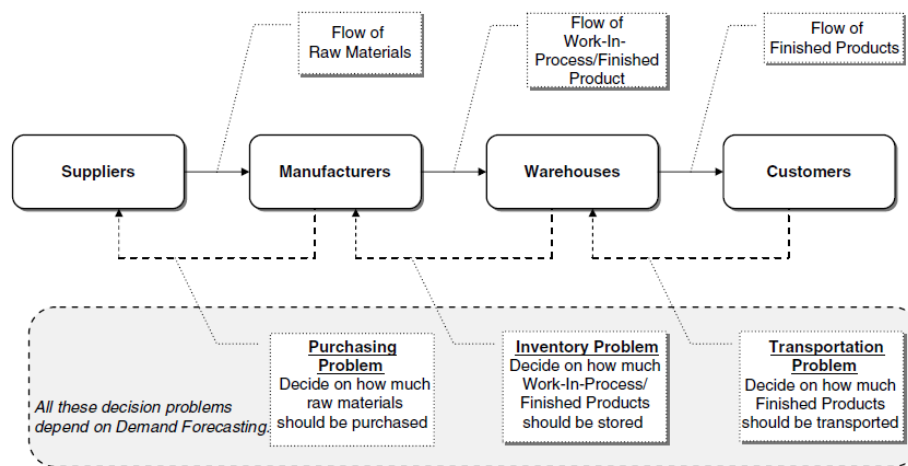


Figure 1. The role of demand forecasting in logistics supply chain management.

The analytical hierarchy process, is a theory of measurement for dealing with quantifiable and nonquantifiable criteria [5]. It can be applied to numerous areas such as performance measurement in higher education, and demand forecasting in logistics [4]. Since the analytical hierarchy process can provide a systematic framework for the decision-makers to interact and discuss about every factors relating to the decisions, it is selected as a tool to analyze the criteria affecting the demand, and most importantly, determine the demand growth in the future.

The analytical hierarchy process consists of three main operations including hierarchy construction, priority analysis, and consistency verification. First of all, the decision-makers need to break down a complex multiple criteria decision problem into its component parts of which every possible attributes are

arranged into multiple hierarchical levels. For example, overall goal, criteria, attributes of each criterion are in the first, the second, and the third levels, respectively. After that, the decision-makers have to compare each cluster in the same level in a pairwise fashion basing on their own experience and knowledge. For instance, every two criteria in the second level are compared at each time whereas every two attributes of the same criteria in the third level are compared at a time. Since the comparisons are carried out through personal or say subjective judgments, some degree of inconsistency may occur. To guarantee that the judgments are consistent, the final operation called consistency verification, which is regarded as one of the most advantages of the analytical hierarchy process, is incorporated in order to measure the degree of consistency among the pairwise comparisons by computing the consistency ratio [1]. If it is found that the consistency ratio exceeds the limit, the decision-makers should review and revise the pairwise comparisons.

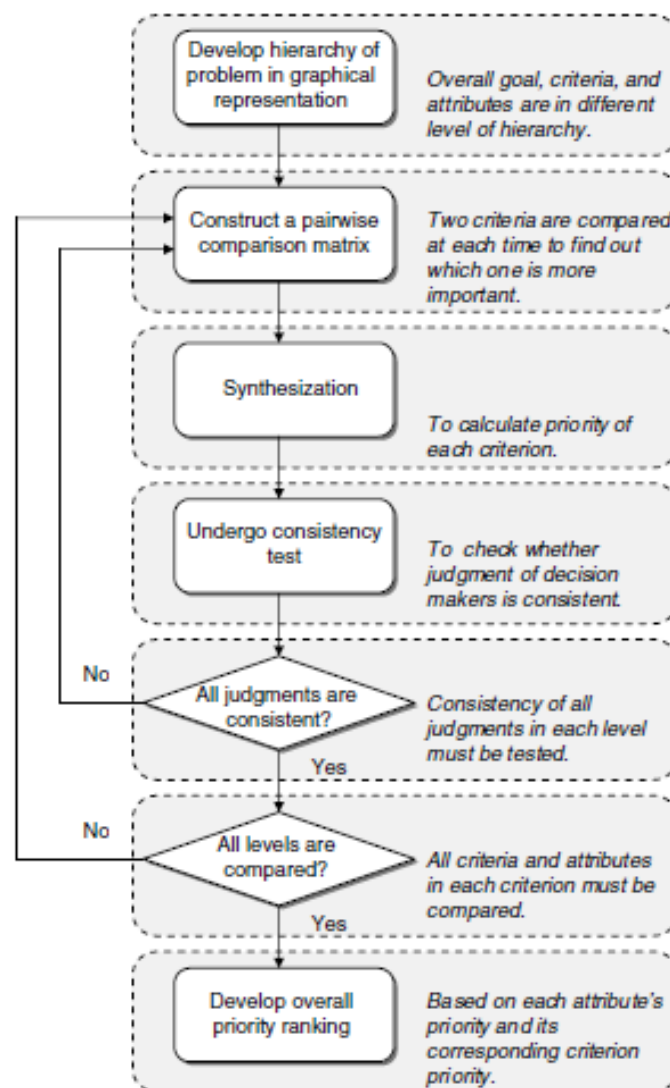


Figure 2. The algorithm of the analytical hierarchy process

Once all pairwise comparisons are carried out in every level, and are proved to be consistent, the judgments can then be synthesized to find out the priority ranking of each criterion and its attributes. The overall procedure of the analytical hierarchy process is shown in figure 2.

After the dependent and independent variables are defined, and the historical data of all variables are obtained, a forecasting mathematical equation can be formulated. It is noted that the use of regression analysis for trend projection is a time-series method rather than a casual method. Consider the quantitative data of the m - independent variables in period t ($t = 1, 2, \dots, n$) is collected. The proposed forecasting mathematical equation can be constructed in (1). Besides, the mean absolute percentage error M method, formulated in (2), is used to evaluate the accuracy and performance of the multiple regression analysis.

$$F_t = c_0 + c_1x_{1t} + c_2x_{2t} + \dots + c_nx_{nt} \quad (1)$$

$$M = \frac{1}{n} \sum_{t=1}^n \frac{|F_t - A_t|}{A_t} \quad (2)$$

Where:

A_t - actual value of demand in period t ;

F_t - forecasted value of demand in period t ;

x_{it} - value of independent variable i in period t ($i = 1, 2, \dots, m$);

c_i - forecasted regression coefficients of independent variable i ;

c_0 - constant coefficient

The regression coefficients indicate the relative importance of the corresponding independent variable in forecasting the value of the dependent variable, and dominate the accuracy of the equation. To minimize the error of forecasted demand, the best sets of coefficients must be generated (fig 3).

After that, initial parameters represented in continuous value are generated randomly. There are $(m + 1)$ values in each parameter if m independent variables are selected in the phase of multiple regression analysis. Each parameter is then measured by equation (2). These steps form one iteration, and then the roulette wheel selection method is performed again to start the next iteration. The method will not stop unless the predetermined number of iterations is conducted.

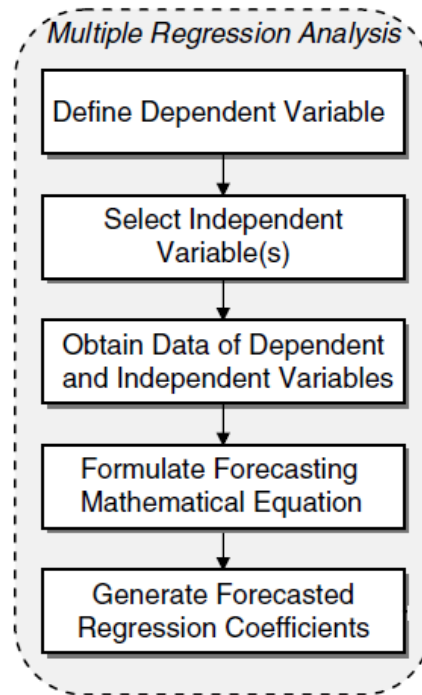


Figure 3. Multiple regression analysis

III. Conclusion

Having constructed the hierarchical tree, logistics practitioners make use of pairwise comparison to find out the interrelation among the factors. As supply chain involves various parties including suppliers, distributors, retailers, and customers each of them can contribute to construct the hierarchy. Pairwise comparison is then made through discussion, bargaining, and persuasion. Demand forecasting is a complex issue and the value chain embraces various parties with widely varying perspectives.

REFERENCES:

- [1] Anikin B. s kolektiv. Logistika. M., izd. INFRA – Moskva, 2001.
- [2] Bassan, Y., Roll, Y., and Rosenblatt, M. J. (1999). Internal Layout Design of a Warehouse. IIE Transactions.
- [3] Heizer, J. and Render, B., Operations Management, 7th ed., Prentice-Hall, London, 2003.
- [4] Chang, P.C., Evolving neural network for printed circuit board salesforecasting, Expert Systems with Applications, 2005.
- [5] Saaty, T.L., The Analytic Hierarchy Process, McGraw-Hill, New York, 2008.
- [6] Wooldridge, M. An introduction to Multiagent Systems – Second Edition. By John Wiley and Sons, USA, May, 2009



A METHOD FOR FACILITIES LOCATION AND WEARHOUSE LAYOUT DESIGN

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ABSTRACT: Organizations and enterprises around the world differ greatly in terms of mission, scale, and scope. Yet all of them aim to deploy the best possible network of facilities worldwide for developing, producing, distributing, selling and servicing their products and offers to their targeted markets and clients. Underlying this continuous quest for optimal network deployment is the facility location and layout design engineering.

KEY WORDS: warehouses, location decision, storage area.

I. Introduction

Organizations and enterprises around the world differ greatly in terms of mission, scale, and scope. Yet all of them aim to deploy the best possible network of facilities worldwide for developing, producing, distributing, selling and servicing their products and offers to their targeted markets and clients.

II. Exposition

The intensity and pace of this flux is growing in response to fast and important market, industry and infrastructure transformations. Location and layout design is being transformed, from mostly being a cost-minimization sporadic project to being a business-enabling continuous process; a process embedded in a wider encompassing demand and supply chain design process, itself embedded in a business design [5].

Figure 1 exhibits levels of layout representation used for design purposes. The least aggregate first level, here termed processor layout, shows the location and shape of the building, each center, each aisle and each significant processor within each center.

At the second level of aggregation lies the net layout which does not show the processors within each center. The assumption when focusing the design process on the net layout is that prior to developing the entire layout for the

facility, space estimates have been made for each center, leading to area and shape specifications, and that as long as these spatial specifications are satisfied, then the net layout embeds most of the critical design issues. The space estimation may involve designing a priori potential alternative processor layouts for each center. The transposition of the net layout to a processor layout for the overall facility is left as a detailed exercise where the layout of each center is developed given the shape and location decided through the net layout.

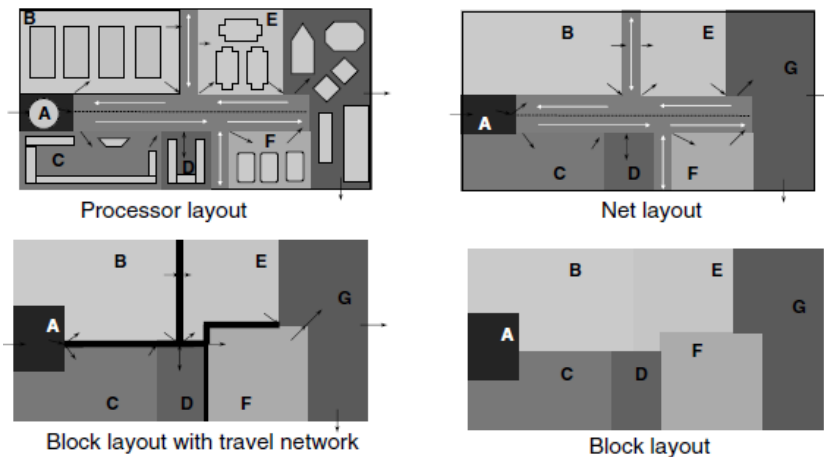


Fig. 1. Degrees of aggregation in layout representation for design purposes.

At this third level, instead of including the aisle set explicitly, the design depicts the logical travel network [3]. This network, or combination of networks, connects the I/O stations of the centers as well as the facility entry and exit locations. There may be a network representing aisle travel, or even more specifically people travel or vehicle travel. Other networks may represent travel along an overhead conveyor or a monorail. The network is superimposed on the block layout, allowing the easy alteration of one or the other without having to always maintain integrity between them during the design process, which eases the editing process. Links of the network can be drawn proportional to their expected traffic.

At the fourth level of aggregation, the travel network is not depicted, leaving only the block layout and I/O stations [2, 4]. Editing such a block layout with only input/output stations depicted is easy with most current drawing packages. These stations clearly depict where flow is to enter and exit each center in the layout. Even though the I/O stations of each center can be located anywhere within the center, in practice most of the times they are located either at center periphery or at its centroid. The former is usually in concordance with prior space specifications. It is commonly used when it is known that the center is to be an assembly line, a U-shape cell, a major piece of equipment with clear input and output locations, a walled zone with access doors, etc.

The absence of travel network representation assumes that the design of the network and the aisle set can be straightforwardly realized afterward without

distorting the essence of the network, and that flow travel can be easily approximated without explicit specification of the travel network. Normally, one of the two following assumptions justifies flow approximation. The first is that a free flow movement is representative, computed either through the rectilinear or Euclidean distance between the I/O stations between which a flow is expected to occur. Figure 2 illustrates these two types of free flow.

Euclidean distance assumes that one can travel almost directly from one station to another while rectilinear distance assumes orthogonal staircase travel along the X and Y axes, like through a typical aisle set when one does not have to backtrack along any of the axes. The second alternative assumption is that flow travel is to occur along the center boundaries.

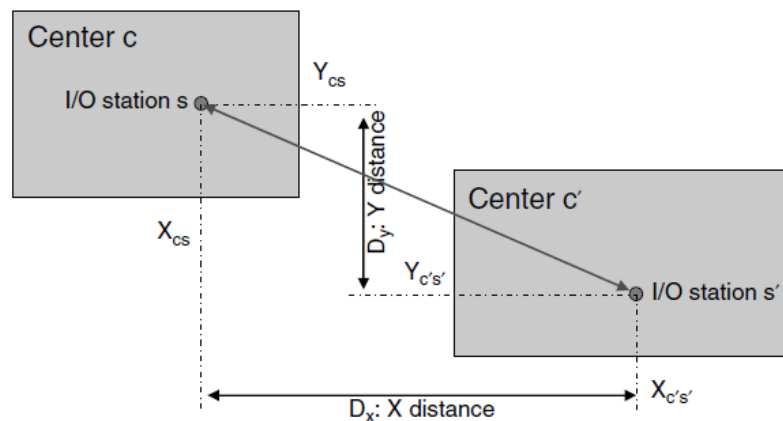


Figure 2 Free flow distance measured according to rectilinear or Euclidean distance.

$$\begin{aligned} D_R &= D_x + D_y ; \\ D_E &= \sqrt{D_x^2 + D_y^2} , \end{aligned} \quad (1)$$

Where:

D_R - rectilinear distance;

D_E - euclidean distance.

Thus distances can be measured accordingly through the shortest path between the two I/O stations of each flow, along the contour network of the facility. This network is implicitly created by inserting a node at each corner of one center and the facility, and inserting a link along each center or facility boundary segment between the nodes. In Figure 1, a flow from the northern output station of center B to the input station of center G would be assumed to travel from the output station of B southward along the west boundary of center B, then turning eastbound and traveling along the southern boundaries of center E, and keeping straight forward to reach the input station of center G.

Location and layout is about locating and shaping centers in facilities or around the world. The design effort attempts to generate expected value for the organization through spatial configuration of the centers within a facility, or of facilities in wide geographical areas. Space is thus at the nexus of location and layout design. It is therefore not surprising that representation of space has long been recognized to be an important design issue. The essential struggle is between a discrete and a continuous representation of space.

Facilities location and layout are both inherently prone to hierarchical aggregation so as to best direct design attention and harness the complexity and scale of the design space. Depending on the scope of design decisions to be taken, the engineer selects the appropriate level of aggregation. Yet he must always take advantage of in-depth knowledge of higher and lower levels of aggregation to leverage potential options, taking advantage of installed assets and fostering synergies.

III. Conclusion

In most operational settings, the flow of materials and resources is a key for evaluating and optimizing a layout or location decision. It is sometimes sufficient to treat it through qualitative relationships. However, in most cases it is far more valuable to treat flow explicitly. Flow generally defines the amount of equivalent trips to be traveled from a source to a destination per planning period. There are two basic flow issues at stake here associated with implementing a design. First is the expected flow travel or flow intensity. Second is the flow traffic. The former is generically computed by summing over all pairs of entities having flow exchanges, the product of the flow value between them and their travel distance, time or cost, depending on the setting. Flow travel has long been used as the main flow-related criterion for evaluating alternative layout and location designs.

References:

- [1]. Harrison T P, L.L. Traft L L Global supply chain management at Digital Equipment Corporation, *Interfaces*, v25, no1, 69–93. NY 2005
- [2]. Bassan, Y., Roll, Y., and Rosenblatt, M. J. (1999). Internal Layout Design of a Warehouse. *IIE Transactions*.
- [3]. Heizer, J. and Render, B., *Operations Management*, 7th ed., Prentice-Hall, London, 2003.
- [4]. Heragu S., Irani M. Next generation factory layouts: research challenges and recent progress, *Interfaces* v32, no6, 58–76. Saaty, T.L., *The Analytic Hierarchy Process*, McGraw-Hill, New York, 2008.
- [5]. Verter (2001). A continuous model for production-distribution system design, *European Journal of Operational Research*, v129, no2, 287–298. 2009



OVERVIEW OF A SOFTWARE PRODUCT “ANYLOGIC” USED IN TRAINING OF STUDENTS IN GENERAL ENGINEERING

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ABSTRACT: *The design of a complex logistics system requires many people and resources to support the design of the various elements and stages, that can be used for specialized software products. One of the software that can be used for designing logistic systems such as warehouses, storage equipment, industrial buildings, transport schemes for road, rail, sea, air and combined transport is “AnyLogic” .*

Therefore the aim of this work is to present “AnyLogic” software product and its application in education of students in general engineering.

KEY WORDS: *AnyLogic, logistic system models, simulations.*

1. Introduction

In modern learning environment provide opportunities to include educational content and activities with a high degree of interactivity and the ability to simulate various situations, such as systems and objects with abstract nature [5].

This report gives an overview of a software (AnyLogic), which is used in the training of students specialized in "Engineering Logistic" and is associated with the development and application of simulation in logistic.

2. Exposure

“AnyLogic” is the only simulation tool that supports all approaches to create a simulation of logistic processes.

The software allows to examine any aspect of the modeling system of any level of detail of graphical interface, tools and libraries. Creating models for a

wide range of applications for modeling manufacturing, logistic, business models and processes for strategic development (Fig. 1).

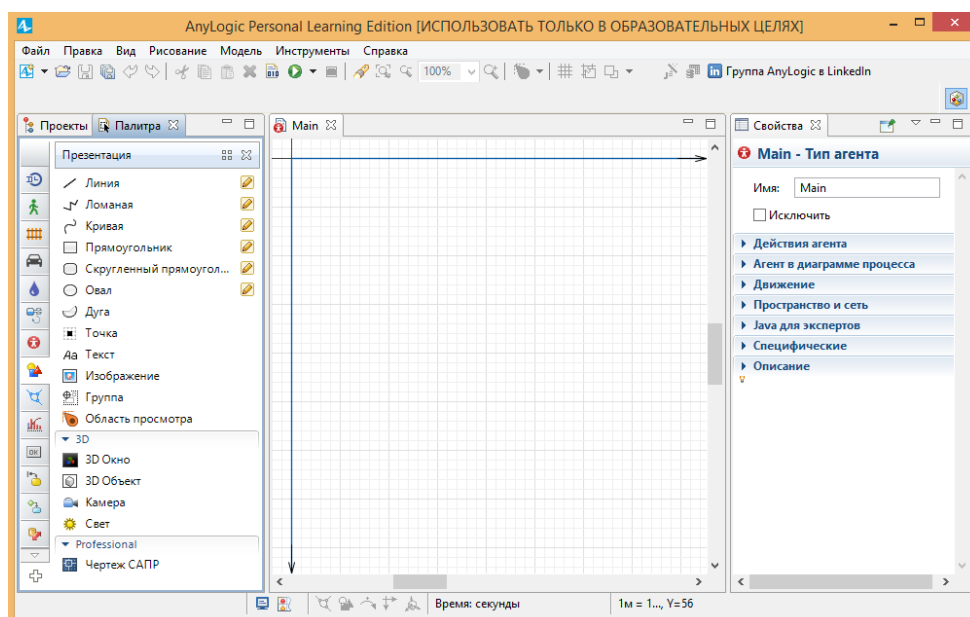
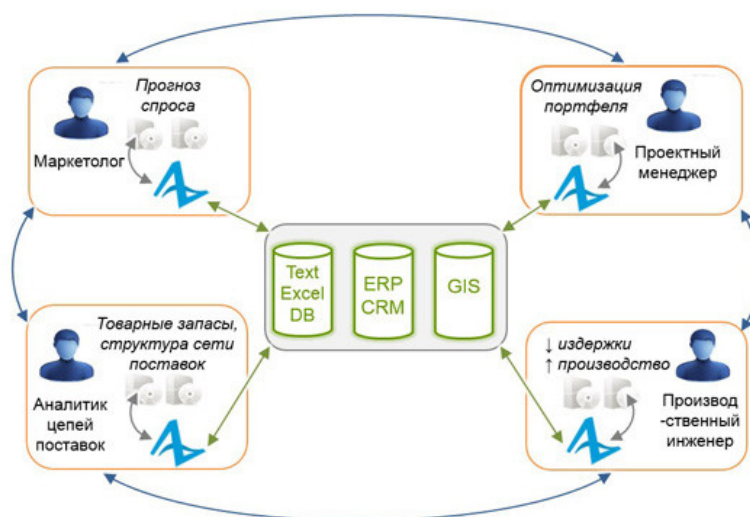


Fig. 1. Overview of AnyLogic

“AnyLogic” allows to link different simulation models created in various departments. For example, a model combining internal structure of distribution centers and external supply. Chain with information about consumer behavior thus obtain precise recommendations about the amount of inventory or production plans (Figure 2). [4] All this is possible thanks to multitask modeling, which makes “AnyLogic” unique.



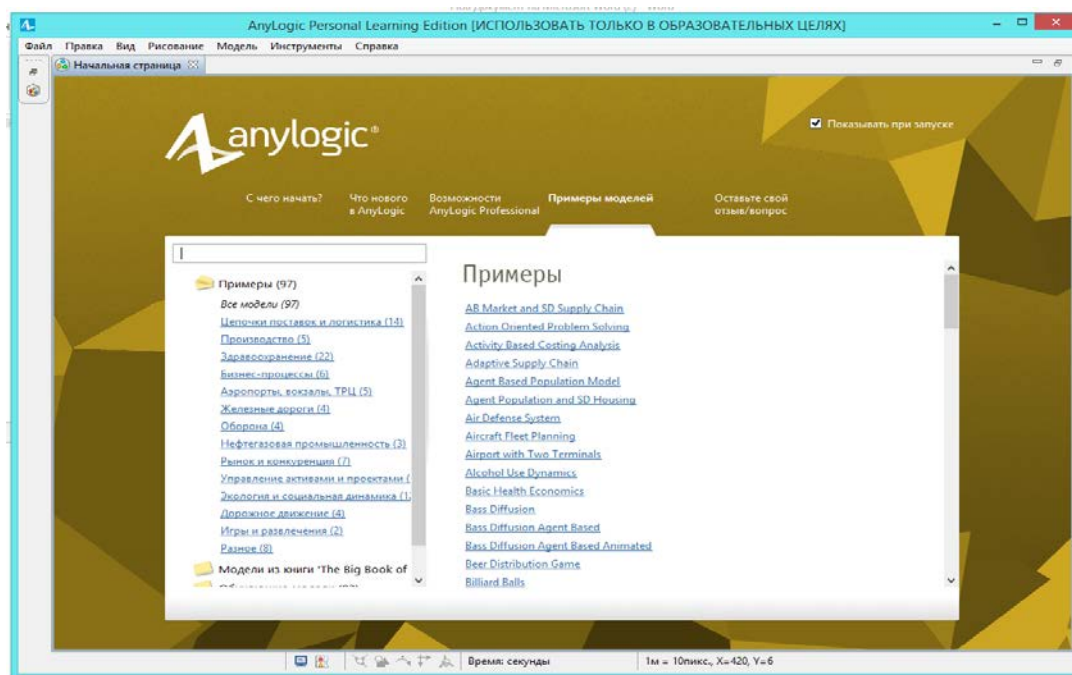
Pic.2. “AnyLogic” connect with different departments

“AnyLogic” can use different sources of GIS maps (eg, OpenStreetMap, shapefiles), to import CAD drawings and 3D-models or work with different optimization packages (eg, OptQuest) and tools for selecting the probability distribution. “AnyLogic” can easily be integrated with existing databases such as MS SQL, Oracle, text, Excel files and software for business management. [1 ... 4] Fully e compatible with CRM, ERP, BPM, BI and other software (Fig. 3) [4], which helps to make the right decisions to make optimization "on the fly" to carry out test scripts "what if" and more. AnyLogic is suitable for solving daily tasks and long-term planning



Pic.2. “AnyLogic” connected with different departments

“AnyLogic” can use different sources of GIS maps (eg, OpenStreetMap, shapefiles), to import CAD drawings and 3D-models or work with different optimization packages. (eg, OptQuest) Also use tools for selecting the probability distribution. “AnyLogic” can easily be integrated with existing databases such as MS SQL, Oracle, text, Excel files and software for business management. [1 ... 4] Fully e compatible with CRM, ERP, BPM, BI and other software (Fig. 3) [4], which helps to make the right decisions to make optimization "on the fly" to carry out test scripts "what if" and more. “AnyLogic” is suitable for solving daily tasks and long-term planning.



Pic. 4. library of sample 2D and 3D simulations

3.Conclusion

By studying AnyLogic students learn all aspects of modeling logistic systems at any level. Detail of graphical interface, tools and libraries to quickly create models for a wide range of applications for modeling manufacturing, logistic, business models and processes for strategic development .

REFERENCES:

- [1]. Boev, V. D, Working with GIS kartami in AnyLogic 7.1, Saint - Petersburg, 2015
- [2]. Boev, V. D, КОМПЬЮТЕРНОЕ МОДЕЛИРОВАНИЕ, tool dlya prakticheskikh occupation kursovogo and diplomnogo proektirovaniya in AnyLogic 7 Saint - Petersburg, 2014
- [3]. Katalevskiy, DU, Основы имитационного моделирования and системного analysis in upravlenii, Moscow, 2015, ISBN 978-5-7749-1072-4
- [4]. <http://www.anylogic.ru>, Imitatsionnaya platform dlya polnogo business cycles, 2016
- [5]. http://www.leo.swu.bg/file.php/1/papers/Simulations_A4.pdf, Tuparov D., D. Dureva, T. mousses, simulatsiionni interactive learning objects.



ATTITUDE TOWARDS WORK IN ORGANIZATION

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ABSTRACT: *Copyright description of some aspects of modern organization employees' attitude towards work. Based on analysis of attitudes towards work it has been clarified why work performance of knowledgeable, skilled and experienced workers often does not meet employers' expectations.*

KEY WORDS: *attitude towards work, work performance, work behavior.*

Attitude towards work can be seen at various levels from the perspective of the individual, organization and society. These different levels are intertwined in people's lives. Modern organization is no longer a place where people only go to work knowing that they will receive their pay, but is also a place where employees want to express themselves, to feel valued and fulfilled with their accomplishment.

Modern Human Resources Management faces a huge challenge to find the right people to achieve the objectives of the organization while the results of their work fulfill their potential. The realization of work potential of employees depends on the personal need to work and the attitude towards specific job. The outcomes of work tasks yet depend not only on the professional qualities, personal abilities and right attitude towards work, but also the work procedures and working conditions created by the employer.

People, employed or unemployed, cultivate their attitude towards work as positive, neutral or negative. The personal attitude to work is a result of the impact of various factors on the individual in the process of building their employment behavior. The key factors in shaping attitudes towards work can be defined as follow: the perception of work, work motivation, satisfaction with the work performance, as well as education towards work. The way these factors are presented in the individual, shapes her or his work behavior. These factors affect

people in different way causing increase or decrease of their efforts, usage of their knowledge, skills and intellectual potential.

Attitude towards work is in the foundation of personal aspirations to use one's physical and intellectual abilities, knowledge and experience to reach certain employment outcomes.

The results of work performance in organizations are mainly related to the motivation and commitment of employees. Why very often work performance of knowledgeable and skillful employees is not at the desired by the Management level? The answer to this question can be found in many directions - from organizational and technological factors and group dynamics towards personal ambition to apply all available intellect and knowledge up to motivation and attitude to particular job and generally towards work. All these attitudes interact with each other and have different influence on people. Attitudes' expression reflects employees' work performance.

Many employers, faced with low productivity, tend to blame employees in unsatisfactory motivation. Some employers in similar situations introduce motivational programmes. However, often the productivity does not increase with these programmes. This is a reason for serious studies on interaction between motivation and productivity. According to Ronald Riggio, prior to blame workers for their low motivation other factors that directly or indirectly affect productivity must be analysed. These factors, according to him, can be set as four tendencies: variables of systems and technology, variables of individual differences, variables of group dynamics and organizational variables. [1]

The motivation for work is important but employers tend to overestimate it and forget about other factors with serious impact on work productivity of employees. Here arises the question whether the attitude towards work can be associated only with motivation or there is influence by other factors and processes within the organization. Despite the importance of motivation for employees' performance, we must not focus only on it because at the end of the day, it is only one of the factors that determine work efficiency. Focusing on a single factor and neglecting the others creates a rather limited idea about the behavior of people in employment.

Often employers are unaware or are reluctant to admit the real reasons for low level of job performance of employees with proven knowledge, skills and experience caused by problems of inefficient business management of organizations, poor management of human resources and by external influences. These problems provoke employees' undesirable attitude towards work. Often incompetent management leads to changes in attitudes towards work. If we add to this salary levels, we can get a better understanding of attitudes towards work that people build and change during their working lives.

To perceive general attitude towards work of an individual is necessary to consider the process of learning to work and a family model of work, which is

often reproduced later in life by next generation's workforce. Suitable work tasks aiming to develop positive attitude to work should be included in educational programmes from early childhood. To teach someone to work if they have not been taught while young is quite difficult. Even if someone is used to to work, it does not mean that the work is important for this person. People work for various reasons - to earn money for survival, to obtain funds to meet various needs, to accumulate wealth, etc. This means that work as a process is a purposeful activity and functions as a means to achieve desired goals. [2]

People work for reward which will help them satisfy their needs. This is considered a labour of necessity, which could mean that the attitude towards a particular job depends mainly on the habits of individuals to work and on the pay which would allow them to meet a variety of individual needs.

Despite positive impact of work on human existence, survival and development, generations' involvement in work activities proved to be a complicated process. It is easy to an active hardworking person to un-learn to work and it is very difficult an idle one to learn to work. There are people who never worked in their lives. Work inclusion and work alienation are not mutually exclusive. A person can value work, can use the products of labor but at the same can avoid working.

New generation more and more show attitude of work alienation which is a result of negative perception of work, population reproduction dynamics and accepted models for work education in the family. The drop in birth rates and tendency of raising only one child in the family who receives all attention and care creates settings where a child does not learn to work, which consequently forms alienation of work. When children grow they reproduce behavioral patterns of their parents - if one, several or all adults in the family, do not work for some reason - children adopt this as natural and when they reach working age they often do not work and rely on the welfare system or other income.

Training to obtain personal work qualities in the process of work education shapes not only people's attitudes to work, but also outlines an expectancy of standard of living of the individual. Value orientations toward different types of work are established in this process, and as a result, people develop different attitude to different types of work, make career choices or decide to change their current profession.

In order to achieve a high level of performance it is important to pay attention not only to the motivation and attitude of the workers but also to various factors in the organization that are subject to managerial influence. The choice of person whether to employ the minimum or the maximum of their potential heavily depends on those factors.

Modern people have certain expectations not only for nature and character of their jobs, but also for the organization, the leadership and the way of communication in the work process. Introduction of new technologies changes

the nature of work and requirements for workers. These processes become more dynamic nowadays and demand quicker adaptation to changes in job requirements. It is almost impossible to work in the same job position throughout entire working life as it used to be possible for many people 50-60 years ago. It also becomes impossible for an individual with a certain range of knowledge and skills acquired in a certain stage of their life to work until their retirement. Continuous learning is becoming necessity for employees in order to maintain their professional skills at desired by the employer level. Continuous maintenance and accumulation of new knowledge require not only a motivation, but depends on available resources because in addition to work everyone has a personal life which involves other types of work activities. The continuous upgrading of knowledge and skills takes time and investment. When income from salary does not allow you to invest in yourself, the quality of your work will deteriorate. Employers often prefer to hire highly qualified people and cut the resources for training. When all these factors act simultaneously each individual makes a choice that depends on the balance between personal and professional life.

On an organizational level these influences can be considered from two positions - problems of work performance resulting from employee's negative attitudes towards work and problems of work performance resulting from organizational and managerial impacts.

The problems in work performance are resulting from employee's negative attitudes towards work are basically due to lack of work habits. For people who have not learned to work working is overwhelming. There is always someone or something they blame for creating problems and they often feel misunderstood. They frequently change different job and always find an excuse to leave current job and just stop working. Most often they state as an excuse that their pay is insufficient, they may not go well with their colleagues or the manager does not value them. Such situations can occur with people with established good work habits, but when the same scenario is repeated three or more times, then the person should realize that the problem is nothing to do with employers, managers and or colleagues – the problem is perhaps in themselves and they should try to change themselves and their attitude to work.

The problems of work performance resulting from organizational and managerial impacts can be of a different nature. The most common are problems in group dynamics, lack of good communication between leaders and employees, too many written and unwritten rules and poorly structured job roles etc.

Even when employees have the knowledge, skills and right attitudes essential to fulfill the position, they often do not reach the results expected by their employer. Why is that? Where expectations of employers and those of the staff disagree?

Primary goals for the employers are profits and economic efficiency. Employees, however, may have different purposes and financial reward is not always the most important results from their work performance. People expect to reconcile personal and professional life and to feel satisfied with their work. Nobody wants to work in an environment with constant conflicts between colleagues, managers or juniors, with overruled policies and imbalanced distribution of job roles and tasks between work positions.

Over the last few decades Human Resources Management changed significantly to meet the growing expectations of the people in the modern organization. Are these changes really enough? Are the expectations of employees too high or the management of changes in organizations is falling behind? On the one hand, there is a need for organizational and management changes that create conditions to meet people's expectations. On the other hand, it is important to enhance work education towards appropriate employment behavior.

There are still many questions related to people's attitude towards work but the main question is under what conditions expectations of employers and employees will meet. Is it time for modern generation attitude towards work to become more positive or it is necessary to build new models for management of human resources to support reaching the balance between the expectations of employees and employers' requirements? The answer to this question can be given after analyzing the organizational and management processes and activities, group dynamics and employees' attitude towards work in a particular organization. The results will reveal what are the problem areas, the main of which have been described above. Then specific decisions on necessary changes will be taken at an organizational level.

References:

- [1]. Ronald E. Riggio. Introduction to industrial organizational/psychology. Sofia. DILOK. 2006. p. 224-226
- [2]. D. Shopov. Labour Economics. Sofia. Trakia-M. 1999. p.18



THE NECESSITY TO IMPLEMENT A JOB ANALYSIS SYSTEM WITHIN PUBLIC ADMINISTRATION

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ABSTRACT: *Description of the opportunities to improve human resource management in the public sector by introducing a job analysis system to the public administration. Outlining a few guidelines that will facilitate the achievement of the fourth goal of the Strategy for development of the public administration by introducing a job analysis system.*

KEY WORDS: *job analysis, job analysis system, public administration.*

The restructuring of Bulgaria's public administration according to EU's requirements calls for rethinking its goals and priorities in the view of greater efficiency and expenditure reduction. This reduction comes as a consequence of the limited resources that the state may allocate for public services. Great effort has been put towards improving efficiency, motivation and training, but a lot less emphasis is being put on optimizing business process. The emphasis is put on improving the skills and qualifications of the staff. The improvement of motivation is done primarily at linear leadership level. An adequate optimization of any business process must be done on the basis of job analysis system, but that is not usually done in this manner. Using an analysis of the business process will allow for a more adequate distribution of tasks between the departments and between specific employees. [1] Developing and introducing a job analysis system will be vital to the management of the human resources in the public administration, as well as an important tool for the optimization of the business processes and the structural development of a public institution.

The increasing demand to cut down expenditure and raise the efficiency within the public sector postulates the need to find and introduce new methods in order to achieve those very same goals. As tools that will yield such results are: better planning, more effective governing, better structuring including of the business processes, more effective control, working schemes that make personal selection and evaluation more effective, creating opportunities for career development, creating proper stimulus and better motivation.

The job analysis can be employed as a tool for perfecting the business processes. The introduction of a job analysis system will be vital to the workings of Bulgaria's public sector that is because it will allow mitigating some negative trends concerning personal selection, training, career growth, promotions. It also will be very helpful as far as restructuring and the development of the job descriptions are concerned.

According to the fourth of the Strategy for modernization of administration "Bulgaria's administration will be able to answer adequately to the needs both of the public and industry if it has well motivated personnel, who excel at their professionalism and expertise. That calls for reforms in the policy of human resource management in the administration that will allow for its management to be more efficient and effective. With emphasis on career development and acquisition of new knowledge and skill, this will enable the individual employee to better perform his tasks." [2] This strategic goal is described by its six areas which it will affect: *evaluation and planning of the needs of the personal; improved selection; improvement of skill; policies for career development; incising the capacity to participate in the EU's decision making process and to perform Bulgaria's obligations; upgrading the departments responsible for the human resources; introduction of hi-tech solutions to the business processes.*

Those six areas will greatly benefit from the information that will be gathered with a job analysis.

In the area of *evaluation and planning of the needs of the personal* the information gathered with a job analysis will be beneficial to:

Job designing— as it is pointed in the strategy the practice of job designing will expend. According to the theory and the practical experience of the successful organizations the job designing is preceded by a job analysis. According to Ivanchevich and Lobanov a job analysis goes through eight stages. During these eight stages passes in the existing organizations, and for the newly formed there are additional activities. Particularly important is considered to be the first step, which gives an overview of the functioning of the organization as a whole and reveals the importance of each position (workflow). In the second stage the analyst must decide how and which information to use for the design of the position. In the third stage is determined which position / positions to be analyzed. In the fourth stage, with the help of certain methods to collect the necessary information on the content of the position and the requirements towards the employee. The information obtained is used in the fifth stage of job description and the sixth stage of developing job specification. ***Data collected from the first to the sixth stage serve at the seventh stage to design the positions.*** In the eighth stage the designed in the previous stage positions are evaluated and introduced. [3]

The job analysis provides a solid basis for the job design, it provides for a better structuring of tasks, duties, responsibilities and demands to the one who is

going to exercise a given job. They will be taking into account the specifics of each position within every particular public institution;

– Human resource planning – a job analysis is fundamental for any HR planning. It will clarify the tasks that a given position must perform within a given administrative structure; it will also serve as a basis for determining the most optimal number of employees needed in a certain category in any general or specialized administration.

According to the strategy the methods for *improved selection* “will be modernized and improved, in order to guarantee that only the most appropriate and best qualified candidates will be hired” [2]. In order for this aim to be achieved first and foremost before starting with the selection process, the specific tasks and obligations of a given position must be defined, as well as the necessary knowledge, skill set, attitude and experience that a candidate must possess. By the *Job specification*, which will be developed during the process of analysis, will outline unified criteria for determining the requirements for attracting and selecting candidates for a given position. Professional specification or specification of the position is developed in two parts: the first are the skills needed to fulfill the position: education, training, specialized training, personal qualities and abilities and the second part includes physical requirements brought by the office to employees (requirements for walking standing, talking, etc., needed to complete a job), work environment and risk situations. Michael Armstrong formulates the following key features that must contain the professional specification, required for the job knowledge, skills and professional qualities; experience and qualifications necessary for the performance of his duties; age restrictions, if necessary; career prospects; Performance characteristics; terms and conditions of employment. [4]

During the selection process the ones conducting it will be able to use the information provided with the job specifications for a specific position to determine which of the candidates possesses the necessary knowledge and skill set to carry out the duties of that particular position.

According to the strategy the *policies for career development* will be based on the elaboration of “specific career pathways, which will provide for the employee a clear perspective of their career development, according to their own interests and competence”. [2] The introduction of a comprehensive and systematic job analysis to all the positions in the administration will provide information for all the functions, activities and tasks performed by a given administrative structure, which will be grouped in fields according to function and performed tasks – that by itself is the outline of a career field. Within a specific field the functions, the tasks, the responsibilities will be organized in hierarchical manner, and this will enable the creation of career pathways. They will give the opportunity to an employee to have a horizontal as well as vertical career development. Within one career field many career pathways may be

developed, it is desirable that they be tied to achieving certain benchmarks. When the job specification for every position is written down, then it becomes clear, what are the required skills for performing the duties of every given position. When we take into account the fact that the professional development is a voluntary process and the forcible one is undesirable, it becomes apparent that the employees that should be stimulated are not just the ones who have the abilities, but also the desire to. This should be a “step by step” process where periodically goals are set and those goals are related to the career development of an employee. It’s advisable that those goals are set during the process of attestation. In that way the links between professional development and evaluation will be improved. Then it will be possible to assess the fitness of an employee to the position that this person desires, as well as making apparent any need for him to acquire more knowledge and professional experience before furthering one’s career.

The elaboration of a system for career development will take the information gathered during the job analysis and will provide with a understanding which positions will benefit from horizontal and which will benefit from vertical development and in what way the career fields and pathways must be synchronized.

Skill improvement within the dynamic development of the internal and external environment of the public institutions calls for an ongoing improvement of the skill set, the knowledge and attitude of the employees. The restructuring, modernization as well as the introduction of a hi-tech solutions calls for a constant improvement of the skill set, the knowledge and attitude of the employees. Through the job analysis it is possible to determine the changes that are occurring in the business processes, the new demands and the demands that are outdated towards the skill set, the knowledge and attitude. It will be possible to assess which is outdated and no longer needed, and which one needs updating. On that basis it will be determined the need for higher or lower demands towards the level of education and/or skill for a specific tenure.

The ever growing demand for improvement of the skills in the modern world calls for investment in the human resources. In order to avoid the scattering of resources by conducting mass trainings – that is the usual practice at the moment – only the employees that are lacking in knowledge should attend any trainings and it must be in the area where they need it. After the job analysis outlines the necessary skill set, knowledge, attitude and experience only then it is possible to compare between what is needed and the actual situation. After that it can be evaluated where a skill set needs improving or the attitude is in need of improvement or the knowledge of the employee is not up to date.

According to the strategy in the areas of *upgrading the departments responsible for the human resources and introduction of hi-tech solutions to the business processes* the emphasis is put on “introducing hi – tech solutions to the

management of human resources in the public administration". [2] The development of the organizations structure ways as well as the staff itself and the functional structuring of their human resources management units will be the basis for increasing the efficiency of the public organizations. In order to create the optimal structure and standards, which intertwine the number of employees needed at the human resource departments with the overall number of employees in a given institution an analysis of the business processes and tasks needs to be conducted. It will provide the necessary information and show where certain business processes and departments need to be restructured, according to their tasks, obligations and responsibilities and the opportunities for them to be grouped by positions. According to Beers design of a position is a process that must go through three phases. The first is an analysis of individual tasks (***what tasks will be implemented***). The second phase is the specification of methods for implementation of each task (***exactly how to be performed***). The third phase is a combination of individual tasks in specific works and giving them to the employee (***how to group the various tasks to form the position***). This phase corresponds closely to the process of organizational structuring and creation of job descriptions.[5]

The job analysis may show if there is a need for any change in the number of employees for optimal efficiency.

The employment of the job analysis as a practical tool by the HR specialists in the public sector is rarely done. The job analysis is a very labor intensive and time-consuming – which calls for understanding its importance, understanding the process itself and the products coming out of the business processes as well as their application to the function of an employee, time to produce well-trained analysts. Every organization needs to apply a suited for her conditions model for job analysis, which will facilitate the personal management, as well as the basic management functions. The job analysis as a tool for surveying the state and content of the positions is a prerequisite for improving the management of human resources. The introduction of an integrated system for it to the public sector in Bulgaria will give the ability for the management of the human factor on the basis of position requirements, and not to be used as a way of finding a new job for the already employed.

It is a challenge for the employers to develop and introduce a working system for job analysis because the process of that analysis is very labor intensive, it calls for interdisciplinary knowledge, understanding and effort, and the fact that it is not very popular makes the implementation even harder.

The analytical models may be called differently it does not matter if they are called a technique, system or a method. The important thing is to realize that they are a tool for gathering, analyzing, sorting, using and storing information through which a real survey of the content and state of positions is being conducted as well as of the employees that hold them. The gathered information

is needed by the leadership and the experts at strategic level, when HR managing programs are being elaborated and by the specialists at operative level.

The introduction of a job analysis system will answer to the challenges of our present – more flexible, more efficient and productive employees, who are fulfilling the requirements of their job descriptions and at the same time they are satisfied with their occupation.

The introduction of an integrated system for job analysis in the public administration will give the ability for the management of the human factor on the basis of position requirements.

References:

- [1]. N. Boteva. Job analysis – a tool for human resources management at the Ministry of defense (dissertation paper). Sofia. „G. S. Rakovski“ National Defense Academy. 2014. p. 127
- [2]. Working for the people: strategy for development of the public administration 2014 – 2020, pp. 62-74
- [3]. M. Ivanchevich, A. Lobanov. Human resources management. Moscow. Delo. 1993. p. 247
- [4]. Armstrong M. Handbook of Human Resource Management. Burgas. Delfin pres. 1993. p. 158
- [5]. L. Byars, L. Rue. Human Resource Mamagement. Boston. IRWIN. 1987. p. 134



FOLIAR DUST DEPOSITIONS ON URBAN PLANTS

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ABSTRACT. Studies of dust deposition on plants growing along road dividers in the city of Mumbai was carried out in December-2009 and March-2010. Foliar dust from the most commonly grown ornamental plant species found in the city, *Bougainvillea spectabilis* Willd, *Ficus benjamina* Linn., *Nerium odorum* Aiton and *Pedilanthus tithymaloides* Poit. was estimated to understand the dust capturing potentials. The leaves of these were collected from three different sites within the city viz, Colaba, Western Suburb and Western Express Highway. Each site differed in the type of vehicles and the study was aimed at comparing dust fall in different areas of the city. *Nerium odorum* Aiton showed maximum dust capturing capacity. The area Colaba, was relatively less dusty in comparison to other sites. The study shows that plants can be effectively be used to monitor dust and mitigate the problem to some extent.

KEY WORDS: dust, urban plants, phytomonitors, green belt choice

INTRODUCTION:

Mumbai is a densely polluted and populated city. SPM (Suspended Particulate Matter) is a major contributor to air pollution. The Air Quality Laboratory, at Khar shows high concentrations of SPM within the city (Table 1). Urban trees have effectively being used in the city in past to assess the level of dust pollution in the city [1, 2 and 3]. Leaf morphology, phyllotaxy and surface characteristics play very important role in dust capturing capacities of plants [3]. Automobile exhaust pollution are the primary cause of air pollution in urban areas (60%) followed by industries (20 – 30%) and fossil fuel [4]. Bio-monitoring of air pollutants through the use of plants, microbes and animals has now become a standard procedure in the study of air pollution ecology [5]. Particulates are deposited on plant surface by three processes – sedimentation by

gravity action, impaction under the influence of precipitation. It has been suggested that impaction is the principal means of deposition [6]. Dust is captured by leaves of plants, leaf epidermal outgrowths like hairs and scales, hairy axils of stems & leaf bases etc. [7].

Several studies have been conducted on the effects of air pollutants on plant in India and elsewhere since past several decades. Rao [8] have listed plants in respective localities with higher dust capturing capacities absorb and combat pollution. The current work was undertaken to assess the dust deposition on the leaves of plants growing along the city roads having different traffic densities and to observe the variation in dust deposition on leaves with respect to species and season.

Table 1: SPM Levels at various localities in Dec-09 and Mar-10 in micrograms/m³

Sites	SPM (December, 2009)		SPM (March, 2010)	
	Average	Maximum	Average	Maximum
Worli	303	347	216	353
Khar	394	430	329	591
Andheri	276	331	320	621
Borivali	162	206	202	202

Courtesy, Air Quality Monitoring Laboratory, Khar, Mumbai. CPCB STANDARDS 200 micrograms/m³

METHODS:

The Study Area: Dust Impaction and sedimentation on the leaves of different plant species was studied at 3 areas of the city of Mumbai.

I- COLABA(C): Predominantly moderate traffic along the roads receiving sea breeze and salt spray. Mainly private vehicles are seen at this site.

II- WESTERN SUBURBS(WS): The site ranges from Bandra to Borivali. Moderate to heavy traffic, sea-breeze in certain areas and construction activity are noticed.

III- WESTERN EXPRESS HIGHWAY(WEH): The site ranges from Bandra to Dahisar. Construction activities and high traffic of all types of vehicles is seen at this site. The air quality data of Khar of western suburbs in Mumbai and Worli closer to south Mumbai is represented in Table 1. The data was obtained from MCGM Air Quality Monitoring and research Laboratory, Khar

Collection of Plant samples:

The leaves of plants growing along the road dividers at Colaba, Western Suburb and Western Express Highway were collected in the months of December 2009 and March 2010. The common species studied at all the three sites were *Bougainvillea spectabilis* Willd, *Ficus benjamina* Linn., *Nerium odorum* Aiton and *Pedilanthus tithymaloides* Poit.. The leaves were collected in Zipper lock bags and brought to the laboratory, and washed with 100 ml water using a brush in a beaker, and then traced on a graph paper and leaf area was

calculated. The water containing the dust was filtered through pre-weighed Whatman's No. 1 filter paper and the filter paper was dried in the oven at 80°C. The dried filter paper was weighed and the difference was noted. The amount of dust present on the leaf is expressed as gm/m².

RESULTS:

The results of dust present on the leaves collected in December 2009 and March 2010 from all three sites in Mumbai are represented in Table 2. It is observed that the maximum dust in the month of December was recorded at Colaba, 18 g/m² was present on the leaf surfaces of *Nerium odorum* Aiton being, 19.3 g/m² at Western Suburb and 21.1 g/m² at Western Express highway. Similarly in March also *Nerium odorum* Aiton leaves were found to be best dust capturer with values 30 g/m² at Colaba, 39.67 g/m² at Western Suburb and 64 g/m² at Western Express highway.

Table 2: Dust in gm/m² on leaves of plants on road at Colaba, Western Suburb and Western Express Highway in Dec-09 and Mar-10

PLANT SPECIES	C DEC 2009	C MAR2010	WS DEC2009	WSMAR 2010	WEHDEC 2009	WEH MAR 2010
<i>Bougainvillea spectabilis</i> Willd	1.17	1.2	2.87	5.6	20	11.1
<i>Ficus benjamina</i> Linn.	3.4	3.5	3.33	4.41	18	21.1
<i>Pedilanthus tithymaloides</i> Poit.	6.06	6.2	7.92	20	14.6	27.9
<i>Nerium odorum</i> Aiton	18	30	19.3	39.67	21.1	64

C = Colaba, WS = Western Suburb and WEH = Western Express Highway

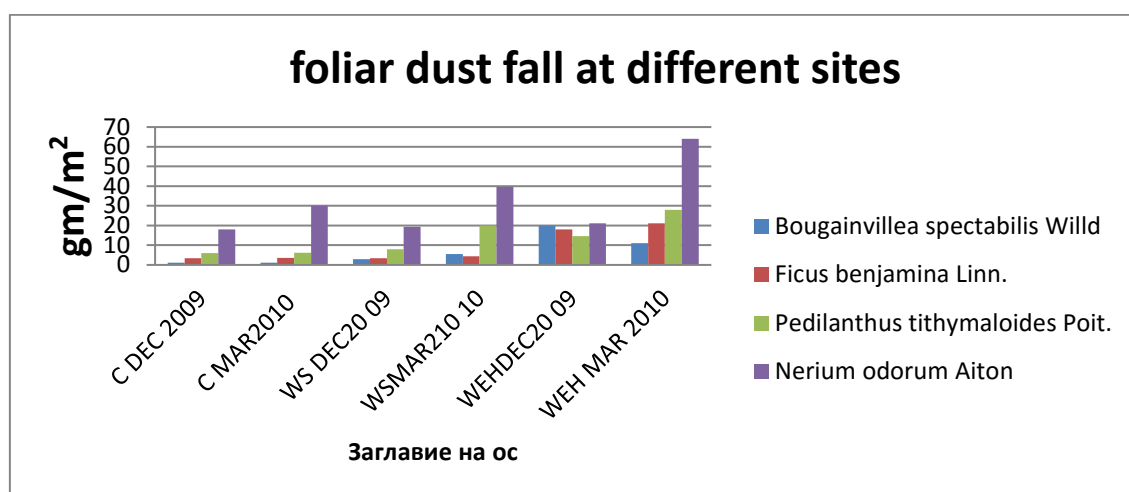


Fig 2: Dust values at Colaba, Western Suburb and Western Express highway in Dec-09 and Mar-10

Colaba area showed least amount of dust on the leaf surfaces of all the plant species, in both the study periods. This is largely due to the area being close to the sea, no three wheelers are allowed to run in this area and restrictions for trucks to run in this area. High foliar dust values were observed at Western Express Highway in both the study periods, this is largely due to constant traffic movement throughout the 24 hrs along this road which connects it to other states of the country. The dust captured by all the plants was more in the month of March. In both the months *Nerium odorum* Aiton leaves showed maximum dust deposition. *Pedilanthus tithymaloides* Poit. and *Ficus benjamina* Linn. showed moderate dust deposition in both the months.

DISCUSSION:

The entire study shows that *Nerium odorum* Aiton leaves have maximum dust deposition. It has whorled phyllotaxy and epidermal outgrowths on its lower surface. *Pedilanthus tithymaloides* Poit. and *Ficus benjamina* Linn are commonly grown along the road dividers within the city which can also effectively be used for monitoring dust. Western Express Highway, which has high density of vehicles, along with construction activities in its vicinity shows maximum foliar dust deposition on its plants, suggesting that urban plants can effectively be used for monitoring dust. There is a necessity to standardize plants for development of green belt and as phytomonitors of dust. The work throws light on phytoremediation of suspended particulate matter using plants on highways, traffic islands and road dividers. *Nerium odorum* Aiton, *Pedilanthus tithymaloides* Poit. and *Ficus benjamina* Linn. can play a very good role in filtering atmosphere.

REFERENCES:

- [1]. Chapekar, S.B (1990). Air pollution in and around Bombay urban area. final report to Min of envt. And forests. AICP project report on plants and pollution.
- [2]. Joshi N.C (1990). Experiments in Phytomonitoring of Urban Atmosphere. Ph.D. Thesis University of Mumbai.
- [3]. Shetye, R. P., and Chapekar, S. B (1980). Some estimations on dust fall in the city of Bombay, using plants. Vol. 4: pp. 61-70. In: Progress in Ecology. V. P. Agarwal and V.K. Sharma (Eds.). Today and tomorrow's Printers and publishers, New Delhi.
- [4]. Sivasamy and Srinevasam (1997). Environmental pollution and its control by trees. Hindu.
- [5]. Varshney, C.K (1992) Role of plants in indicating, monitoring and mitigating air pollution.. In S.K. Wahi, A.K. Agnihotri, J.S. Dharma. Environmental Management In Petroleum Industry. Willey Eastern. pp 401-413.
- [6]. Smith, W. H. (1984). Pollutant uptake by plants. In Treshow, M. Ed. Air pollution and plant life. New York; John Wiley and sons. pp 417-450
- [7]. Das, T. M. (1981). Plants and pollution. Presidential Address, Section of Agricultural Sciences, 68th-Indian Sci. Congr., Varanasi, 1-17.
- [8]. Rao D.N. (1981) Phytomonitoring air pollution. Proc. who workshop on bio indicators indices of environmental pollution. Osmania University.



RESEARCH OF THE AMBIENT AIR POLLUTION IN THE INDUSTRIAL REGION DEVNYA, BULGARIA

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ABSTRACT: *The research has been done in the industrial region Devnya, Bulgaria for the term 2010 – 2014. The period has been chosen in accordance with the coming into force of the IPPC permits of the different operators of production installations. It has been used data from a monitoring station - automated measuring station "Izvorite" as the monthly and average annual concentrations of specific air pollutants were examined such as: SO₂, NO₂, O₃, CO, C₆H₆, NH₃ and PM₁₀. The results show that the annual average concentrations of air pollutants are below the emission thresholds for the protection of human health. For some pollutants (PM₁₀, SO₂, NO₂, CO and benzene) a seasonal dynamic was observed, associated mostly with emissions from combustion processes - heating in the residential and commercial sector. The results note also, that the measures, pursuant to the Integrated Pollution Prevention and Control permits (IPPC permits) of the industrial and combustion plants in the industrial region Devnya are effective and give their contribution for improvement of the ambient air quality.*

KEY WORDS: *ambient air quality, industrial region Devnya, monitoring station Izvorite, PM₁₀, pollution.*

INTRODUCTION

The research of the ambient air quality is current. This is due to the requirements of [7] for clean air in Europe. It is necessary the implementation of effective strategies to reduce the level of air pollution not only internationally but also locally.

In Bulgaria except the Clean Ambient Air Act, which requires an improvement of the ambient air quality [6], different kinds of environmental documents are implemented to demand of the operators of industrial and combustion plants to use the best available techniques in carrying out industrial activities and effective treatment facilities of harmful substances in exhaust gases. The ultimate goal is decreasing the concentrations of pollutants in

ambient air and reach the standards set to protect human health and the environment as a whole. Regulation No 12 of 15 July 2010 is a typical “tool” for achievement of the reduction of some pollutants in the ambient air by regulating their emission thresholds [15]. The assessment of the ambient air quality and its management [14] also requires the informing the population [12].

A number of authors study the air pollution in environmentally threatened areas in Bulgaria by establishing high concentrations of many pollutants (SO_2 , NO_x , O_3 , CO , benzene) [18] and especially of particulate matter PM_{10} in industrial and urban areas [2, 5, 11, 19].

The purpose of this study is the research of ambient air pollution in the industrial region Devnya, the concentrations of pollutants to be compared with the permitted limit values and the effect of coming into force of IPPC permits of operators of industrial installations for improving of the ambient air quality to be assessed.

MATERIAL AND METHODS

The study has been done in the industrial region Devnya. Devnya Municipality is located in northeastern Bulgaria, district of Varna, an area of 121.052 km². Devnya is approximately 30 km far away from the district city Varna, in a small valley, surrounded on all sides by low limestone hills as this favors the development of various industries in the area. In the industrial region Devnya there are plants with high rate of production, which are essential for the national economy. Solvay Sodi JSC is a plant for production of light and dense synthetic soda, and soda bicarbonate as a by-product for food processing and industrial consumers. Agropolychim JSC is one of the main leaders in production of fertilizers in the Balkans. There are two production lines at the plant – one for the production of nitrogen fertilizers which includes production of ammonia, nitric acid, ammonium nitrate and urea ammonium nitrate solution and another one for the production of phosphate fertilizers which includes phosphoric acid, sodium tripolyphosphate, triple superphosphate and compound fertilizers monoammonium phosphate and diammonium phosphate. Deven JSC is a co-generating power station for thermal and electrical power. The power station is based on separate combustion of imported coal, petroleum coke, natural gas and mazut. Produced thermal and electrical power is transferred to the other industrial plants in the region as part of the electrical energy is transferred to the national energy system. Part from the industrial region is also Devnya Cement JSC, which is plant for production of clinker and cement. The main raw materials for cement production are limestone, sand and marl.

In Devnya there is a monitoring station of the ambient air, which is part of the national system for monitoring and control – the automatic monitoring station Izvorite with nonstop operation. The station has been operating since 1990 and gives data about the concentrations of main pollutants, which are

essential for the ambient air quality in real time. The automatic monitoring station Izvorite which is placed in region “River Devnya” is classified as an industrial / urban background monitoring station with a range 10-100 m/100 m-2 km. The station is handled by Regional laboratory Varna, which is a department of the Executive Environmental Agency at the Ministry of Environment and Water. At the monitoring station concentrations of the following pollutants are measured: sulfur dioxide SO_2 , nitrogen dioxide NO_2 , carbon monoxide CO , ozone O_3 , particulate matter 10 μm in diameter PM_{10} , ammonia NH_3 and benzene C_6H_6 . The assessment of the ambient air pollution is based on a data from the monitoring station for the five-year period: from 2010 to 2014.

RESULTS AND DISCUSSION

The results from the monitoring about sulfur dioxide show that for the entire period of research the average annual concentrations of SO_2 are significantly below the limit value – average daily limit value for protection of the human health ($125 \mu\text{g}/\text{m}^3$) [15]. At the beginning of the research (2010) the average annual concentration of SO_2 is highest – $10.25 \mu\text{g}/\text{m}^3$. There is a descending trend in sulfur dioxide pollution and in the end of the period (2014) the average annual concentration reaches $5.69 \mu\text{g}/\text{m}^3$.

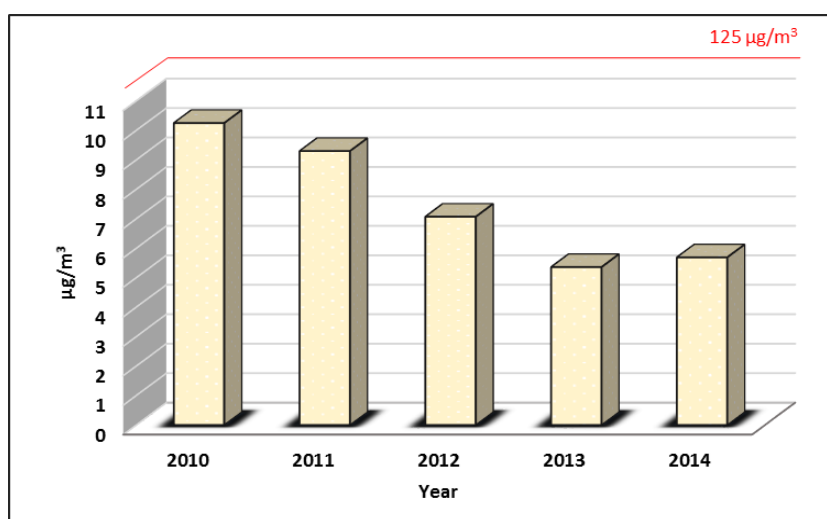


Fig. 1. Average annual SO_2 concentrations in the ambient air

The data for the monthly concentrations of sulfur dioxide for 2010 and 2013 is marked in fig.2. It is chosen the period when the highest and lowest annual average concentrations of the pollutant are registered (in fig.1).

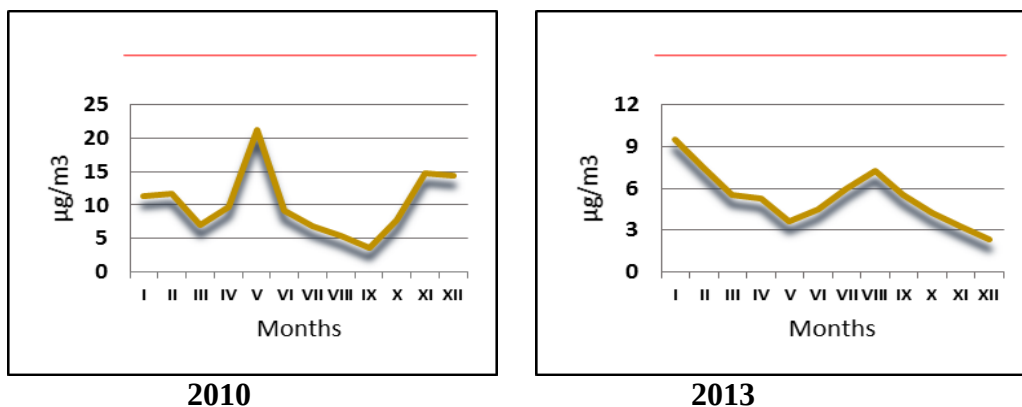


Fig. 2. Average monthly SO₂ concentrations in the ambient air

It is obvious from the results that the average monthly concentrations of sulfur dioxide are the highest through the winter months. The highest values of sulfur dioxide are during the months November and December of 2010 – respectively $14.82 \mu\text{g}/\text{m}^3$ and $14.42 \mu\text{g}/\text{m}^3$ (the exception is observed in May – $21.14 \mu\text{g}/\text{m}^3$). In 2013 again the highest concentrations of sulfur dioxide are reported through the winter months – January and February, respectively $9.46 \mu\text{g}/\text{m}^3$ and $7.38 \mu\text{g}/\text{m}^3$. We can summarize the higher concentrations of sulfur dioxide during the winter periods are not random, but they are a result of combustion processes and mostly of the residential heating in the use of solid and liquid fuels with high sulfur content.

The average annual concentrations of nitrogen dioxide for the period of research are presented in fig.3. It is very clear that concentrations of NO₂ are under the average annual limit value for the protection of the human health - $40 \mu\text{g}/\text{m}^3$ [15]. The highest average annual concentration of nitrogen dioxide is established at the beginning of the period of the research in 2010 – $20.0 \mu\text{g}/\text{m}^3$. After 2011 the average annual concentrations gradually are declining from $18.2 \mu\text{g}/\text{m}^3$ to $12.15 \mu\text{g}/\text{m}^3$ (in 2014). It is typing a model of a descending trend.

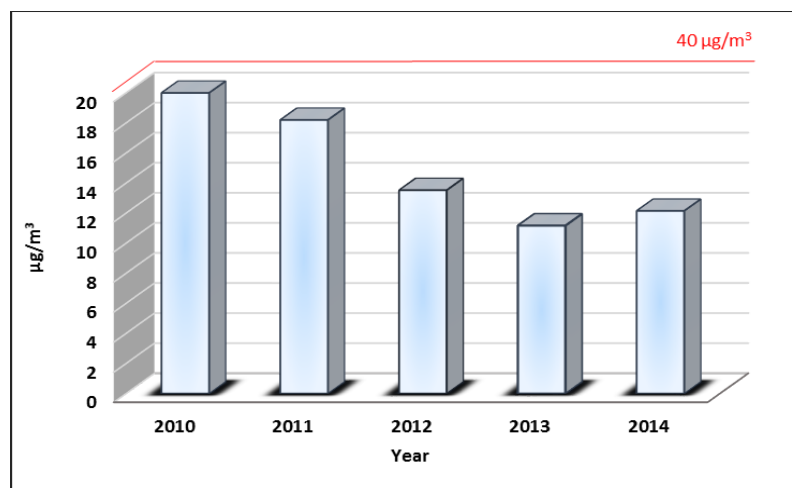


Fig. 3. Average annual NO₂ concentrations in the ambient air

In fig.4 the average monthly concentrations of nitrogen dioxide are represented in 2010, (at the beginning of the research) and in 2013, when there is a drop of the pollution by NO₂. The results show that the most contamination is during the winter months, but the limit value for the protection of human health for NO₂ (40 µg/m³), is not exceeded. Through the two years of research, the highest monthly concentrations of nitrogen dioxide are reported during the period November – December. In 2010 the average monthly concentrations reach 31.05 – 32.96 µg/m³, and in 2013 the highest monthly concentrations in December is 19.08 µg/m³. The annual monthly concentrations express seasonal relation in the ambient air pollution by nitrogen dioxide. The impact on the higher values in concentrations during the cold months of the year is mainly caused by the combustion processes. In the industrial region Devnya it is places the co-generating power plant “Deven”. Except this the heating in the residential and commercial sector contributes to pollution not only by sulfur dioxide but also by nitrogen dioxide.

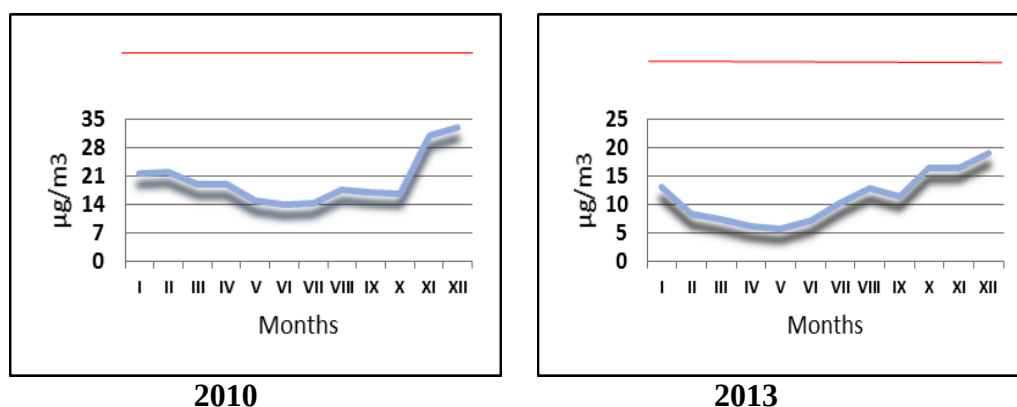


Fig. 4. Average monthly NO₂ concentrations in the ambient air

The results about carbon monoxide show (fig.5) that the average annual concentrations of CO are below the limit value for protection of the human health – maximum eight hours average value for twenty-four hours (10.0 mg/m³) [15]. There is no trend in the pollution by carbon monoxide. The average annual concentrations of CO vary from 0.30 mg/m³ to 0.69 mg/m³, as the highest value is established in 2012 – 0.69 mg/m³. After 2012 there is a gradually descending of the concentrations and the lowest levels of CO are in the end of the research in 2014, when the average annual concentrations reach 0.30 mg/m³.

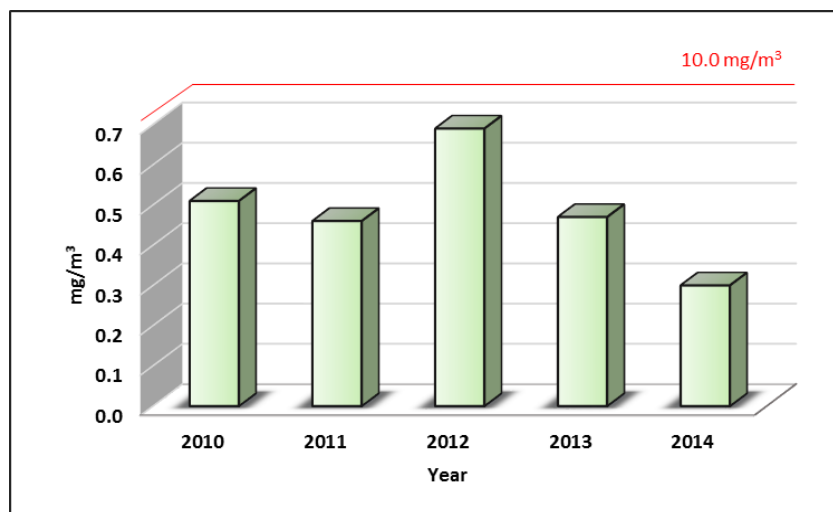


Fig. 5. Average annual CO concentrations in the ambient air

Data about the monthly concentrations of CO for 2012 and 2014 is indicated in fig.6, because during these periods there are the highest and the lowest pollution with carbon monoxide. From the results it is observed that the average monthly concentrations of CO are significantly below the limit values in both years. In 2012 the highest levels of the pollutant are established during the winter months – the highest average monthly concentration of CO is in February, which is 0.93 mg/m³. In 2014 it is observed again high average monthly values of carbon monoxide during the heating season – the highest concentration of CO is in January – 0.54 mg/m³. The seasonal relation of the pollution with carbon monoxide is caused by the residential heating during the winter period of the year mainly with burning of coals in home stoves.

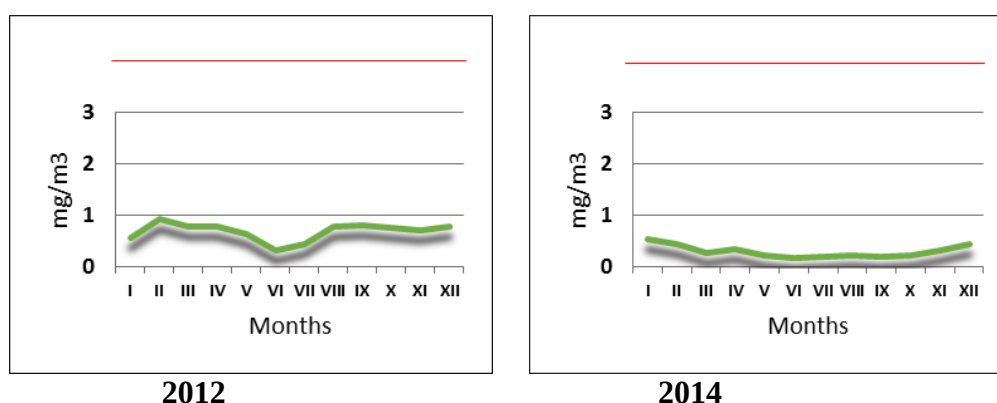


Fig. 6. Average monthly CO concentrations in the ambient air

The ozone (O₃) is a powerful oxidant, which is a powerful pollutant. It does not emit directly to atmosphere. It is a result of the interaction of nitrogen oxides and volatile organic compounds under the influence of high temperatures and solar radiation. There are no significant variations in air pollution with ozone for the whole period of research. It is obvious from the data in fig.7, the average

annual concentrations of O_3 are below the limit value for protection of the human health – the maximum eight-hour value within the day ($120 \mu\text{g}/\text{m}^3$) [15]. The average annual concentrations of ozone range from $32.77 \mu\text{g}/\text{m}^3$ (2012) to $44.42 \mu\text{g}/\text{m}^3$ (2010).

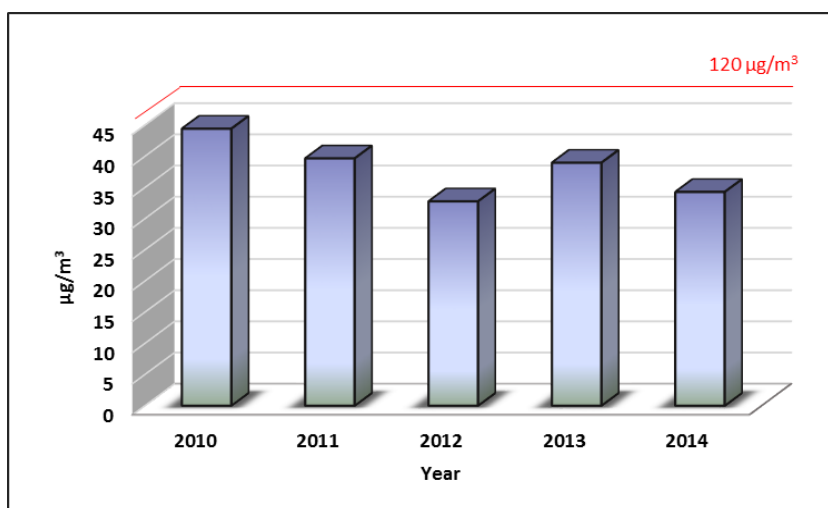


Fig. 7. Average annual O_3 concentrations in the ambient air

Data about average monthly concentrations of ozone in 2010 and 2012 are presented in fig.8 when there is highest and lowest level of pollution. It is clearly that the average monthly concentrations of ozone are higher during the spring – summer months of the year. In 2012 the highest average monthly concentration is founded in July – $44.49 \mu\text{g}/\text{m}^3$. The seasonal relation and the higher levels of O_3 in the hot period of the year are due to the higher intensity of solar radiation during the summer months. As we mentioned earlier, the ozone is a secondary pollutant which is formed at high temperatures and under the influence of solar radiation.

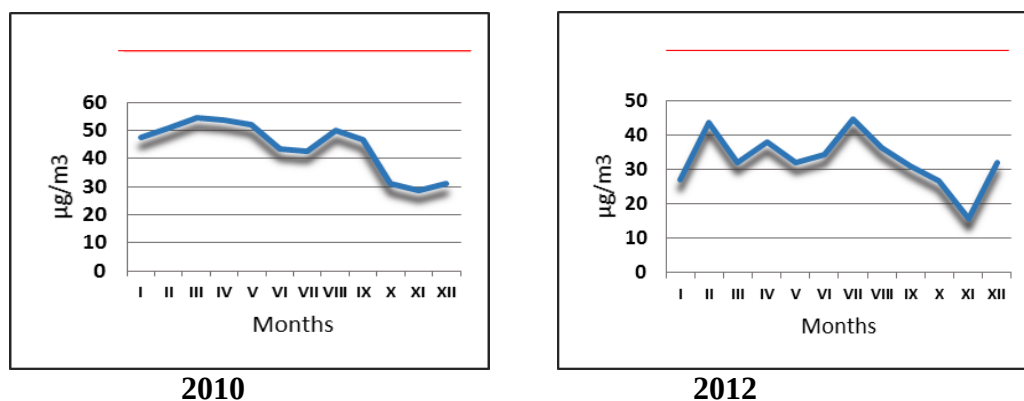


Fig. 8. Average monthly O_3 concentrations in the ambient air

Particulate matter can be transported in the atmosphere for thousands of kilometers, and the pollutants emitted in one country can affect PM₁₀ concentrations in countries which are close or even far away from the source [10].

The average annual concentrations of PM₁₀ for the period 2010 – 2014 are presented in fig.9. At the beginning of the study (2010 – 2011) the average annual concentrations are higher, respectively 23.31 µg/m³ and 20.82 µg/m³ and the average annual limit value for protection of the human health hasn't been exceeded (40 µg/m³) [15]. After 2011 there is a gradually increase of the average annual concentration in 2014 which reaches 30.97 µg/m³. There is an upward trend at the end of the research but the limit value is not exceeded.

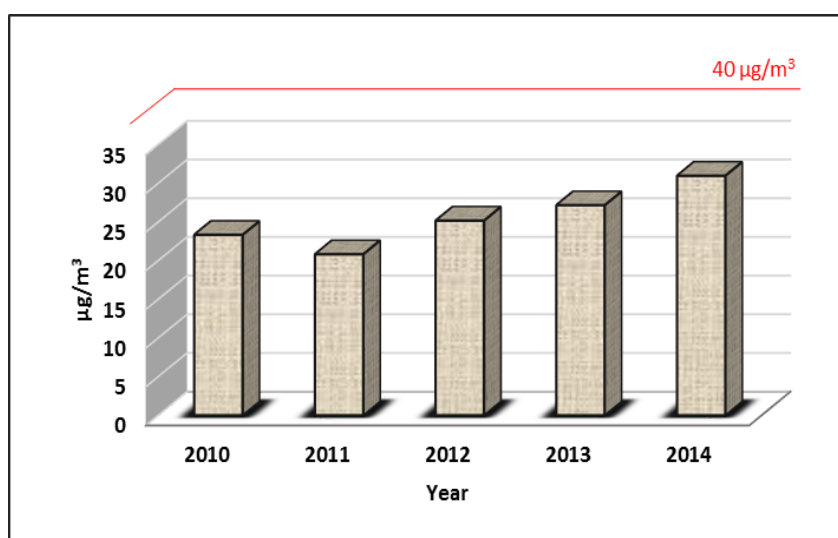


Fig. 9. Average annual PM₁₀ concentrations in the ambient air

It is presented information about the average monthly concentrations of particulate matter about 2011 and 2014 in fig.10. It is chosen the period when there are the lowest and the highest levels of pollution with particulate matter.

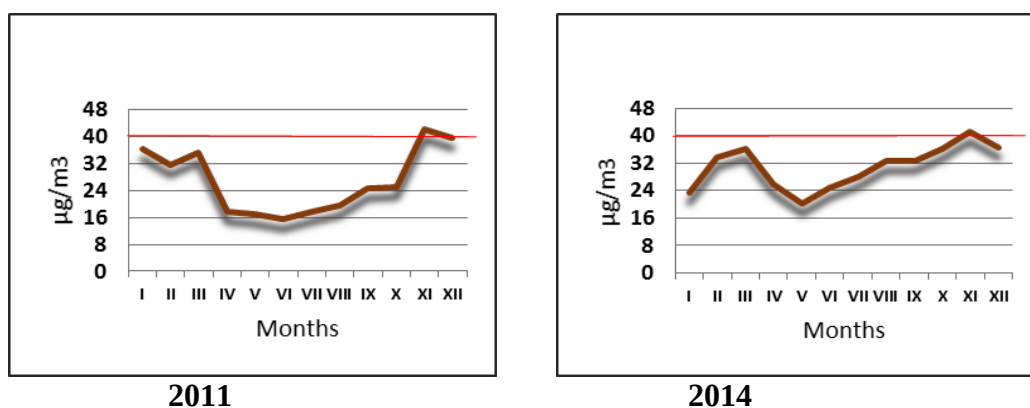


Fig. 10. Average monthly PM₁₀ concentrations in the ambient air

The results in fig.10 show that the average monthly concentrations of particulate matter are significantly higher through the winter heating season. In 2011 the highest average monthly concentrations of PM₁₀ at the station „Izvorite“ are registered in the period January – March (35.02 – 36.11 µg/m³) and in November – December (39.38 – 41.96 µg/m³). The average monthly concentrations of PM₁₀ in November exceed the limit value for protection of the human health 1.05 times. During the summer months, the concentrations of particulate matter vary from 15.62 µg/m³ (in June) to 19.67 µg/m³ (in August).

In 2014 there are again higher concentrations during the winter months. The highest average monthly concentrations of PM₁₀ are in November and December – till 36.65µg/m³ and till 41.18 µg/m³, as the average annual limit value for protection of the human health has been exceeded 1.03 times. The high concentrations of PM₁₀ during the cold months of the year are mainly related to the residential heating with burning of coals and firewood. Another sources of particulate matter in the industrial region are the co-generating power plant “Deven” JSC, where there is mainly burning of coals, which creates a large amount of ash [1], “Devnya Cement” JSC – huge quantities of particulate cement dust is emitted, “Solvay Sodi” JSC for production of synthetic soda ash and “Agropolychim” JSC for production of granulated nitrogen and phosphate fertilizers.

Fig.11 displays the average annual concentrations of benzene in the ambient air. The benzene is with proven carcinogenic effect. The International Agency for research cancer (IARC) classifies the benzene in first group (proven carcinogens for people), as it causes benzene leukemia – cancer of the blood.

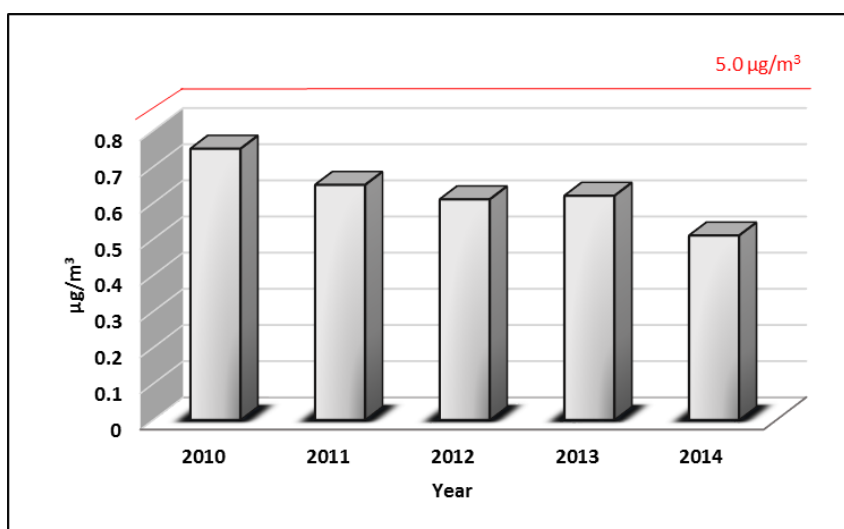


Fig. 11. Average annual concentrations of benzene in the ambient air

As it is visible by the data, there is no significant variations in the average annual concentrations of benzene through the period of the research and the

limit value for protection of the human health has not been exceeded ($5 \mu\text{g}/\text{m}^3$) [15]. The highest average annual concentration is in 2010 – $0.75 \mu\text{g}/\text{m}^3$. After 2010 there is a slight downward trend as the average annual concentrations of benzene reach $0.65 \mu\text{g}/\text{m}^3$ in 2013 and $0.51 \mu\text{g}/\text{m}^3$ in 2014.

The average annual concentrations of benzene in 2010 and in 2014 are shown in fig.12. There are chosen periods in which the concentrations of benzene are respectively highest and lowest.

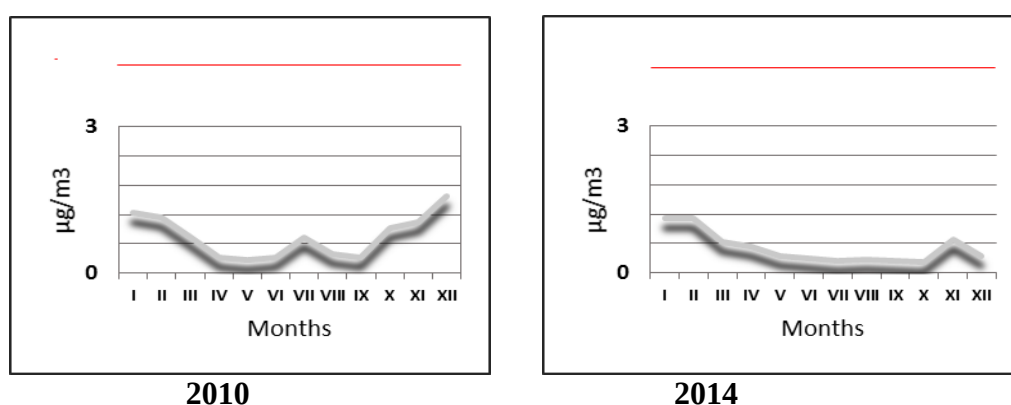


Fig. 12. Average monthly concentrations of benzene in the ambient air

During the two years of research, the highest concentrations are in the winter months respectively in the periods January – February and November – December. In 2010 the highest average monthly concentration is in December – $1.57 \mu\text{g}/\text{m}^3$, and in 2014 – in January and February ($1.12 \mu\text{g}/\text{m}^3$). This seasonal relation with higher values during the cold months and lower levels of pollution during the hot months of the year is mainly due to the combustion processes through the heating season by residential heating with burnings of firewood.

The average annual concentrations of ammonia for the period 2010 – 2014 are presented in fig.13. It is obvious from the results that the average annual concentrations of ammonia for the period of research are significant below the average daily limit ($100 \mu\text{g}/\text{m}^3$) [16]. The highest average annual concentration of NH_3 is in 2010 – $1.85 \mu\text{g}/\text{m}^3$. After 2010 there is a drop of the pollution with ammonia. The average annual concentrations of NH_3 in 2012 and in 2013 are $0.6 - 0.7 \mu\text{g}/\text{m}^3$ and low level of pollution is maintained. The concentrations of ammonia gradually increase in 2014 – the average annual concentration of NH_3 is $1.0 \mu\text{g}/\text{m}^3$, but again it is highly below the limit value. The drop of the average annual concentrations of ammonia during the period of research is mainly due to the low capacity of some productions at Agropolychim JSC (reducing the production of ammonium nitrate, urea ammonium nitrate solution), in which NH_3 is the main pollutant.

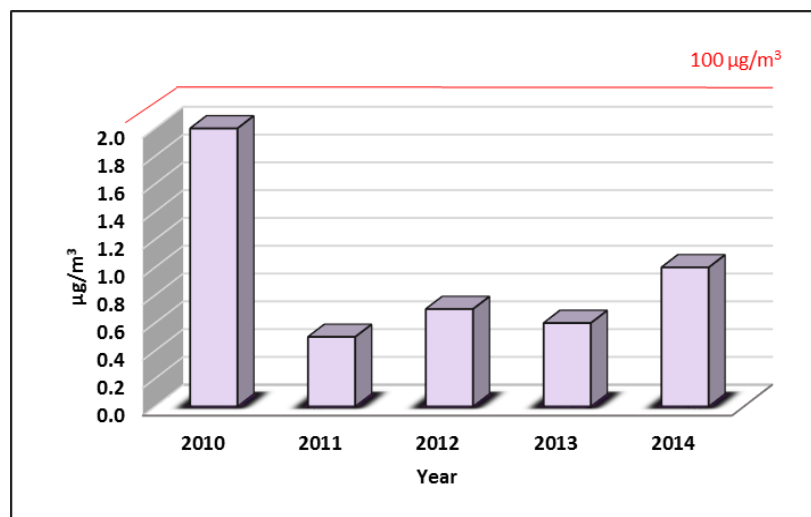


Fig. 13. Average annual NH₃ concentrations in the ambient air

The concentrations of the research pollutants in the ambient air in the period of study are below the limit values for protection of the human health in accordance with Regulation No 12 of 15 July 2010 relating to limit values for sulfur dioxide, nitrogen dioxide, particular matter, lead, benzene, carbon monoxide and ozone in ambient air. The low level of pollution is connected with the implemented IPPC permits of industrial and combustion plants in Devnya region for reducing of harmful emissions and improvement of the ambient air quality. The Directive which concerns the issues from the industry requires integrated pollution prevention and control upon all industrial activities. By this environmental act some special measures come into force, which aim prevention and there where it is not possible – to limitation of the emissions in the environment [8]. For many industrial and combustion plants which are with significant importance for the ambient air quality in some region IPPC permits are required in accordance with the Directive. By the Regulation on terms and methods for IPPC permits issue, the conditions and the order for coming into force of IPPC permits are regulated for construction and operation of new and operation of already existing plants and facilities for different kind of activities according to Annex № 4 of Environmental Protection Act [17, 9]. In some other studies we have analyzed the measures for reducing of the pollution and improvement the ambient air quality in the industrial region Devnya [3, 4, 13].

All plants in the industrial region Devnya have IPPC permits – IPPC permit № 68 of Agropolychim JSC since 14.01.2006; IPPC permit № 63 of Devnya Cement JSC since 14.01.2006; IPPC permit № 74 of Solvay Sodi JSC since 14.01.2006; IPPC permit № 93 of co-generating power plant Deven JSC since 06.05.2006. For implementation of the activities of the IPPC permits in the industrial plants there are introduced monitoring systems for nonstop control and operation of the emissions of harmful substances in the ambient air; at Agropolychim JSC there are implemented high efficiency facilities for tail gases

from dust and the plant for the production of ammonium nitrate is reconstructed; at the co-generating power plant Devn JSC there is a new circulating fluidized-bed steam generator with low level of issues; at Solvay Sodi JSC there is a new line for the production of soda ash dense, an issue free distillation column, a carbonizing column and a limestone blast furnace. As a result of the implemented measures for reduction of issues and introducing new technologies, the ambient air quality is improved.

CONCLUSIONS

As a result of the research it is established that the average annual concentrations of all pollutants in the ambient air in the industrial region Devnya are below the limit values for protection of the human health for the period 2010-2014. For the different pollutants there are different trends. For the sulfur dioxide and nitrogen dioxide it is observed a pronounced downward trend at the end of the period in 2014. The concentrations of PM₁₀ increase gradually at the end of the research, but the limit value for protection of the human health has not been exceeded. About the secondary pollutant ozone there are no very marked variations in the period of the study and the average annual concentrations for the period of research does not exceed the threshold. The research indicates also that it exists a seasonal relation between the pollution of the ambient air and some pollutants as: PM₁₀, SO₂, NO₂, CO and benzene, as during the winter months there are significant higher average monthly concentrations as compared to the summer months of the year. The seasonal dynamic is associated mainly with emissions from combustion processes – the heating in the residential and administrative sector. The results from the research demonstrate that the measures implemented in the IPPC permits of industrial and combustion plants in the industrial region Devnya are effective and contribute to improvement of the ambient air quality.

REFERENCES

- [1]. Almira D., M. Filipova. Distribution of Carbon Monoxide in Almaty city depending on the distance from thermal power plants - 2. Journal Scientific and Applied Research, 2015, vol. 8, 26-30.
- [2]. Chuturkova R. Atmospheric Air Quality Management, 2014, TU – Varna, 248 p., ISBN: 978-954-20-0603-9.
- [3]. Chuturkova R., M. Stefanova, S. Radeva, D. Marinova. Technical Engineering in industrial IPPC as a key tool for ambient air quality improvement. International Journal of Research in Engineering and Technology, 2014, vol. 3, No 8, 8-20.
- [4]. Chuturkova R., S. Radeva, M. Stefanova. Assessment of Harmful Emissions in the Atmospheric Air from the Production of Nitrogen and

- Phosphate Fertilizers. *International Journal of Sustainable Development*, 2014, vol. 18, 128-133.
- [5]. Chuturkova R. Air Pollution, 2015, TU - Varna, Bulgaria
 - [6]. Clean Ambient Air Act. GN 45, 28.5.1996, amendments GN 102, 21.12.2012.
 - [7]. Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe.
 - [8]. Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions, concerning Integrated Pollution Prevention and Control.
 - [9]. Environmental Protection Act. GN 91, 25.9.2002, amendments GN 98, 28.11.2014.
 - [10]. Gupta M., M. Gupta, M. Mohan. Assessment of contribution to PM₁₀ concentrations from long range transport of pollutants using WRF/Chem over a subtropical urban airshed. *Atmospheric Pollution Research*, 2013, vol. 4, 405-410.
 - [11]. Kozarev N., 2015, Air quality. Monitoring. Assessment. Management, first edition, Geya – Libris, Sofia, Bulgaria.
 - [12]. National Report of the status and protection of the environment in 2012, accepted by the Council of Ministers, 04.06.2014, Sofia.
 - [13]. Radeva S., R. Chuturkova, M. Stefanova. Assessment of Measures for Reducing Harmful Emissions in Air from Soda Ash Producing Plant in Devnya, Bulgaria. *International Journal of Engineering and Advanced Technology (IJEAT)*, 2015, vol. 4, 139-146.
 - [14]. Regulation No 7 of 3 May 1999 on ambient air quality assessment and management, GN 45, 14.5.1999.
 - [15]. Regulation No 12 of 15 July 2010 relating to limit values for sulfur dioxide, nitrogen dioxide, particular matter, lead, benzene, carbon monoxide and ozone in ambient air, GN 58, 30.07.2010.
 - [16]. Regulation No 14 of 23.9.1997 relating to limit values for harmful substances in ambient air of urban areas. GN 88, 3.10.1997, amendments GN 42, 29.05.2007.
 - [17]. Regulation on terms and methods for IPPC permits issue, GN 80, 9.10.2009, amendments GN 5, 19.01.2016.
 - [18]. Todorova M. Air Pollution with Sulphur Oxides from Industry in South-Western and South-Eastern Regions of Bulgaria. *Journal Scientific and Applied Research*, 2014, vol. 5, 213-224.
 - [19]. Vlaknenski T., P. Stoychev, R. Chuturkova. Dispersion Modeling of Atmospheric Emissions of Particulate Matter (PM₁₀) and Evaluation of the Contribution of Different Sources of Air Pollution in the Town of Svishtov, Bulgaria. *Journal Scientific and Applied Research*, 2014, vol. 5, 202-212.



COMPATIBILITY ASSESSMENT – PROBLEMATIC AREAS AND THINGS LEFT UNSAID

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Abstract: *The purpose of this article is to provide an overview of the essential requirements specific to the Compatibility Assessment which is drawn up under the provisions of Directive 92/43/EEC and Directive 79/409/EEC and pursuant to Art. 31, para. 10 of the Biodiversity Act as well as in conjunction with Art. 20 para. 1 of the Decree on the conditions and procedures for the assessment of the compatibility of plans, programs, projects and investment proposals with the object and purpose of conservation of protected areas. Some critical moments in the Compatibility Assessment have been analyzed herewith, seen not only from their legislative, but above all from their content and methodical side. Some of the weak points in the process of development of Compatibility Assessment based on the specific conditions of Bulgaria have been pointed out and some suggestions have been made on the improvement of the climate for the preparation of an objective Compatibility Assessment.*

Key words: *Directive 92/43/EEC, Compatibility Assessment, Biodiversity Act*

After some initial difficulties related to the conservation regime and the requirements of Art. 6 of the Habitats Directive, and with the exception of some details, Art. 6 has been applied successfully in practice. The legal basis of the conservation regime of Art. 6 para. 3 of the Habitats Directive generally consists of three stages of evaluation, each one of which tries to answer one basic question: “Can a project, a plan, or an investment proposal, individually or together with some other investment intentions, which are completed, in the process of realization or already in exploitation, lead to a significant impact on the components and the conservation objectives of the protected area of Natura 2000 network?” [1]. That is why a preliminary assessment is required for all projects, programmes and investment proposals. It should decide whether there are legal as well as expert prerequisites which make the Compatibility Assessment (CA) mandatory or the project at hand could be accepted without it. During the preliminary assessment it should be clarified whether the realization

of the proposed plan or a project could alone or in combination with some other plans and projects harm an area of importance for the Community or a European protected area under the Birds Directive.

In order to answer this question there are three basic principles that need to be addressed:

1. Does this measure in its essence fulfill the legal definition of a plan, a project or an investment proposal?

2. Does the plan/ project relate to an area under Natura 2000, which in its own turn requires further assessment?

3. Can considerable influences be definitely ruled out in that particular case?

Contrary to the assessment of the need for Compatibility Assessment, Compatibility Assessment itself presents the essence of the whole process of assessment. At the time of its making there is evidence that is being gathered whether a project or a plan would lead to considerable impacts on some substantial components of the protected area under Natura 2000 which are at the same time essential for the achievement of the conservation goals. If the answer to this question is negative the project can be given a green light, if the answer, however, is positive, the project is inadmissible or may be authorized in exceptional cases only, when the examination of the conditions permitting exceptions shows that the legal requirements for such exceptions are met.

Practical experience shows the importance of registering and documenting the results from the primary assessment of the need for CA. This is especially valid in the cases when a decision has been reached that the execution of a plan or a project will not lead to considerable impacts and that is why a procedure for CA is not necessary to be initiated. The report on the assessment of the need for CA records the information used for the decision to be reached and serves as a proof for the conclusions and decisions which were made. It is also important for the assessment of future projects as at that time the cumulative effect of the realized project should be reported.

The preliminary assessment could lead to various results. In some cases the need for CA is so obvious that the preliminary assessment of the need for CA could be considered unnecessary. The preliminary assessment can be brief in the cases when there is no area under Natura 2000 close to the territory subject of the intended project as well as when impacts such as a rupture of the connection between remote areas or the flow of pollutants, transported at great distances, into the rivers are considered impossible. Here the preliminary assessment is more or less restricted to documenting the actual state, e.g. documenting the protected areas included in the assessment. In other cases the situation is a bit clearer which brings up the question of the degree of detail and scope of the preliminary assessment of the need for CA and of the borderline between the preliminary assessment of the need for CA and the CA itself.

The borderline between the preliminary assessment of the need for compatibility assessment and the compatibility assessment itself is not clearly defined in the Habitats Directive or in the Law on biological diversity and there is still complete darkness on the matter. With the objective of obtaining higher efficiency and applicability a distinction should be made between the preliminary assessment and the compatibility assessment within the frame of a graded approach [2].

1. A preliminary assessment is built around the strict principle of caution. It assesses whether in principle there could occur some negative impacts on any area under Natura 2000. Later on, in the process of CA, it is studied whether the negative impact could be rated as considerable for the components of the area which are crucial for the object and goals of conservation.

2. A preliminary assessment should be able to exclude totally the considerable negative impact. What matters here is the “*scale of opportunity*”. If the possibility of a considerable negative impact cannot be ruled out, then there is a need for CA. On the other hand, there is “*the scale of probability*” which is included in CA: how probable it is for a considerable negative impact on the area to occur without the actual need for greater accuracy of forecast.

3. In general, the preliminary assessment is *approximate, based on the information available* on the distribution of species and habitats, as well as on the generally available information on default values (out of experience) for the impact and intensity of violations to an area (e.g. audible or visual interruptions). CA in its own turn is based on *detailed research* which includes mapping of habitats and species, and allows for accurate conclusions on the special chains of influences and harm.

4. A preliminary assessment generally includes damage control measures (mitigating or preventive measures). A CA is required when considerable negative impact could be prevented only through damage control. The CA specifies on the one hand, the negative impact, while on the other, the impact of the damage control measures. CA fully integrates damage control measures. Their planned execution and projected efficiency are presented separately.

This shows that the preliminary assessment on the need for a compatibility assessment is important mostly in cases of plans and projects outside or within the borders of protected areas as well as for small projects lacking in direct impact on protected habitats and species [3].

Compared to these, preliminary assessments (based on the definition presented above) of plans and projects within protected areas are not a suitable tool as the possibilities which occur in such cases and the potential for negative impact are mostly the subject of CA.

For a good CA it is necessary to have both qualitative and quantitative information on all components of the protected area which are essential to the object and purpose of preservation as well as such which may be affected by the

plan or project. In addition to the collection of data from standardized forms or existing management plans, as a rule, mappings to identify the specific distribution of habitat types and species in the scope of the project or plan are also needed. The corresponding range and intensity of impact factors are of importance for the delimitation of the area and the scope of the study [4].

It is not always easy to decide on the characteristic species from the protected habitats which require information within a CA. There is a variety of species typical for a habitat type. The choice of important data to be collected so that a decision could be reached should focus on those species/ groups of species, which on one hand are susceptible to the impact factors induced by the project, and which, on the other hand, are typical for the habitats of the studied region, and thus potentially occur in them. Above all, species will determine the scope of the study, due to their sensitivity to factors with long-range effects such as noise, light or fragmentation.

It is not necessary to study the characteristic species (groups of species), which up to the present moment have not exhibited any effects as a result of certain impact factors, or which in the particular case might be excluded as a possible impact target [5]. This applies to all species that do not show any other specific vulnerability but the one characteristic of the habitat type; they cannot provide additional important decision-making information.

In practice, it is still open to debates whether it is still necessary in the work with specific species to use the biocenotic, therefore the indirect observation of groups of species (ecological guilds), or to concentrate on single important species which as an important component of the area can indirectly determine the result of the compatibility assessment of a project.

The significance of impacts is always determined separately for each specific case. The most frequent criteria to be used are the scope, intensity and duration of impact [6].

Even if the significance of the impact of a particular project does not lead firmly to its inadmissibility, it is frequently the reason for the project to be reworked, special damage control measures to be implemented or for assessment of exceptions to be conducted.

Although the significance of impacts within CA is determined independently and according to specific scales laid down in Art. 6 para. 3 of the Habitats Directive, the term "significance" not only creates certain linguistic but also content-methodological problems. Determining the threshold of significance poses a major problem in its use [7].

There is no quantification of the degree of impact. Concepts such as "low impact", "medium impact", "high impact", "no effect" are commonly used in the text of any report but are not evaluated in terms of quantitative indicators. When it is a matter of impact assessment of a habitat which is under protection in a protected area, the problem is solved to a great degree by its presence or absence

in the area included in the investment proposal. When a habitat is affected by an investment intention the degree of impact is assessed quantitatively based on the ratio between the percentage of damaged territory and the total representation of the habitat in the specific area or in the country as a whole.

Whether any use of space and the associated destruction of habitats subject to conservation in the protected area must be assessed as a significant impact or there could be exceptions in the cases when it is a matter of a very small area losses in relatively large habitats as well as in habitats in a similar state has been and continues to be a controversial issue among scholars.

As there are no envisioned measures to assure coherence for the impacts considered insignificant, such habitat losses could lead to a constant reduction and slow-acting destruction of the area of Natura 2000 network.

That is why habitat losses in the big sites of Natura 2000 should be assessed as considerable even in cases in which they look relatively small compared to the total size of the type of habitat in the site. Impacts should be assessed first on the basis of some qualitative-functional criteria as well as according to their absolute area size and they should not be assessed as smaller based on a comparison to the size of the site as a whole.

In separate cases, territories outside the protected area should also be taken into consideration as far as there are any expectations for any effects of the impact on the components of the site. In order to achieve certainty of the prognosis in some complicated and dubious cases, the use of more comprehensive methods could be required, such as population viability analysis.

When assessing the impact on animal populations the principles used are the same, with the only difference that the determination of the distribution, abundance and population status is quite difficult and depends entirely on the preparation and accuracy of the person carrying out the CA. In this case the assessment of the degree of impact is quite subjective and it is frequently provoked by commercial motives. Therefore, the method of payment of the labour of the person doing the CA should be seriously reconsidered. Payment is usually made by the investors who having paid the agreed fee expect the conclusion of the assessment to be in their favour; while experts led by their desire to receive their payment are very often not free in their decision-making process.

This could be avoided with the inclusion of a preliminary deposit made by investors to compensate the work of the experts regardless of the final decision of CA. The amount of this fee could be arranged in the Compatibility Assessment Guidelines.

The assessment of cumulative effects is a significant part of CA. When two projects or plans are viewed separately, they might not cross the threshold of significance, however, if they are combined they might lead to a significant impact. In such cases it should be taken into consideration that previous burdens

could possibly increase the sensitivity of a site and that once the official period for the declaration of a site has passed a CA should report on all projects and plans which have been carried out.

Thus a project awaiting approval today could be admitted on the basis of having an insignificant impact, however, a second project with a similar impact might be inadmissible in the future as cumulatively both projects will cross the threshold of eligibility. This justifies on the one hand the need for a system to register in a systemized manner all CAs which have been conducted of all sites and regions, while on the other hand, the need for prudent, managerial, spatial planning decisions, so that should a conflict arise, one could correctly set the priorities following the principle of sustainable spatial planning.

In addition, it should be taken into consideration that the different impact factors are interdependent and that their interaction leads not only to cumulative but also to mutually enhancing (synergetic) effects.

In order to assess the cumulative effect objectively, the experts carrying out the CA should have at their disposal the complete information on all other investment projects in the region which have been completed, admitted or in the process of development which in combination with the plan being assessed could have a negative impact on the protected area. This information is required by the respective regional inspectorate, who is responsible for the assessment of the proposal, however, such information is also very difficult to obtain and as a rule is incomplete and inaccurate. Information cannot be obtained on objects within the powers of other Regional inspections which based on the assessment of the expert could have a cumulative effect through transfer of masses of air or of underground and surface waters.

A mandatory part of the CA is an assessment of the degree of fragmentation of the habitats and populations of species. The effects of fragmentation determined by the facility or its operation can lead to significant impacts principally through two distinct courses of action. They include first the occurrence of barrier effects and disruption of the various forms of spatial and functional relationships between different parts of the habitats and second isolation of different parts of the habitats and populations in which the residual areas are often smaller than the minimum necessary for a species or the habitat for its survival.

The content of the term “fragmentation” is not entirely clearly defined [8]. Is the implementation of the project going to dramatically fragment the habitat and the populations of species in it, so that the individuals of the separate fragments cannot exchange genetic material with each other or is it going to limit the mobility of individuals in the border areas of the fragments. The construction of a house can really be an insurmountable obstacle for some species, but for others it can have a positive effect. New ecological niches emerge and conditions are created for the entry of suburban and synanthropic

species. The urbanization of a site is not always linked to a reduction of biodiversity - if the neighboring areas offer suitable conditions many species migrate there, and new ones that enrich the composition of the biota in the area come in their place.

The impact of fragmentation between the area and its surroundings can be significant when different parts of the habitat or separate parts of the populations of the species are located outside the protected area [4]. In cases of very mobile species (e.g. migratory birds) or species that need habitats of big size (e.g. a vulture, wolf, jackal), the effects of fragmentation between different areas may also have significant negative effects, without directly affecting the area announced in Natura 2000 sites.

The compatibility assessment involves as a main task the evaluation of alternatives [9]. As a rule, the discussion of possible alternatives and assessing their impact on the protected area is carried out formally. Land ownership is the main argument given for the realization of an investment proposal in a particular part of the country. This, however, in no case justifies a positive decision in the CA. A zero alternative is only mentioned as a possibility and is almost never discussed. In it the lost benefits outweigh by far the possible negative effects on the components of the environment and on biodiversity. If a project or a plan is a viable alternative with less or no adverse effects on the Natura 2000 site, then this alternative should be selected. The sponsor of the project is not given any leeway in this case. Only the fact that it is a project whose implementation would be considered the exception to the rule, Article 6 para. 4 of the Habitats Directive [10], requires its avoidance.

“Alternatives” can refer to the technical alternatives and alternatives to the spatial location or route as well as to the content of the project as far as such alternatives are appropriate for the achievement of the objectives of the plan or project with other means.

The apparent higher costs of the implementation of the alternatives are not a fundamental criterion for its rejection [9]. If an alternative has significantly fewer impacts than those preferred by the project proponent, higher costs cannot be the ground for its rejection.

Alternatives that seemed impossible during a previous EIA or in another preliminary process (e.g. a spatial planning procedure) can be considered acceptable and even mandatory if they have fewer negative effects on Natura 2000 sites.

Compensatory measures, if there is still a negative impact found in the implementation of the project, are very banal and almost always the same. As a rule, it is recommended that in the construction and operation of a property the neighboring properties are not affected, that in excavation work the topsoil is removed and disposed of on a designated site in the field, and is later on used for reclamation, that spills of lubricants and transport vehicles fuel is not allowed,

that elements foreign to the local flora and fauna are not to be imported and so on.

In conclusion, we stress the need to rethink some parts of the Regulation on the terms and conditions for assessing the compatibility of plans, programs, projects and investment proposals with the object and purpose of conservation of the protected areas. It is necessary to increase the qualification of the experts responsible for providing compatibility assessments by organizing courses, seminars, discussions and other forms of education.

REFERENCES:

- [1] Manual for Environmental Assessment of Plans and Programmes in Bulgaria, Sofia, 2002.
- [2] Bernotat, D. 2003: FFH-Verträglichkeitsprüfung - Fachliche Anforderungen an die Prüfungen nach § 34 und § 35 BNatSchG. UVP-report, Sonderheft zum UVP-Kongress 12.-14.06.2002, Hamm: 17-26.
- [3] Bernotat, D. 2006: Verhältnis und Berührungspunkte von FFH-Verträglichkeitsprüfung und Managementplanung. Naturschutz und Biologische Vielfalt 26 (in Druck).
- [4] Walker, D., McGrady, M., McCluskie, A., Madders, M. & McLeod, D.R.A. 2005. Resident Golden Eagle ranging behaviour before and after construction of a wind farm in Argyll. Scotland Birds 25: 24–40.
- [5] Bernotat D., & Dr. Axel Ssymank, 2009, Criteria and examples for determining the importance of the impact in the assessment of compatibility. BfN, Leipzig Germany.
- [6] Erickson, P., C.E. Derby, M.D. Strickland, and R.E. Good. 2000. Wildlife Monitoring Studies, SeaWest Windpower Project, Carbon County, Wyoming, 1995-1999. Final report prepared for SeaWest Energy Corporation, and the Bureau of Land Management by Western EcoSystems Technology, Inc. Cheyenne, Wyoming, USA.
- [7] Strategic Environmental Assessment in Spatial/Land Use Planning in the 25 EU Member States, July 2006; “Directory of the existing methods of assessment and prediction of environmental impact”, MOEW, 1997.
- [8] Guidance document on Article 6(4) of the ‘Habitats Directive’ 92/43/EEC clarification of the concepts of: alternative solutions, imperative reasons of overriding public interest, compensatory measures, overall coherence, opinion of the Commission”, EC, January 2007.
- [9] Ramsauer, U. 2000: Die Ausnahmeregelungen des Art. 6 Abs. 4 der FFH-Richtlinie. Natur und Recht 22 (11): 601-611.
- [10] Rainold Schaal, 2010, Legal and methodological framework of Art. 6 (3) and Art. 6 (4) of the Habitats Directive, Ministry for Food and Rural Areas, Baden-Wuerttemberg



BIOLOGICAL DIVERSITY OF MYRIAPOD COMMUNITIES (DIPLOPODA, CHILOPODA) ON THE MADARA PLATEAU, NORTH-EASTERN BULGARIA

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Abstract: *The assessment of the biodiversity of natural complexes has a significant practical application and can be used as a sample for the analysis of the role of environment in the spread and bio-geographic distribution of species, the models of faunogenesis and the establishment of the specific biota. The aim of this research is to study the α - and β -diversity of millipede and centipede communities in the various habitats along the Madara Plateau, North-eastern Bulgaria. The material for the analysis was collected through pitfall traps, arranged in lines of ten on eleven sampling plots, which have been reported on a monthly basis in the period June 2012 - February 2015. A total of 3415 myriapods have been collected – 2776 millipedes of 12 species and 639 centipedes of 16 species. The millipede communities feature higher diversity in species and a comparatively higher degree of equality compared to those of the centipede communities. The forest habitats along the Madara Plateau are characterized with high diversity of millipede communities, while the open areas are the preferred habitat of Chilopoda.*

Keywords: α -diversity, β -diversity, biodiversity, Diplopoda, Chilopoda.

Introduction: Nowadays the preservation of biodiversity is one of the main environmental issues. It has already gained global significance as its reduction leads to destabilization of the biota, violation of the integrity of the biosphere and the conditions for the existence and sustainable development of mankind.

All activities in terms of biodiversity preservation should be based on reliable inventarization of the taxons which has not been completed as of yet. Large-scale international programmes (Planetary Biodiversity Inventory Program, Encyclopaedia of Life, Catalogue of Life, Tree of Life) are trying to fill in the lack of information on various taxons, however, a big number of groups of invertebrates still remain poorly studied and documented.

The assessment of the biodiversity of natural complexes has a significant practical importance as it allows for the genetic potential of the species to be controlled and preserved, it gives an idea of the condition of the eco-systems in a

specific region and serves as the basis for the development of strategies for the management of the protected areas.

The aim of this research is to study the α - and β -diversity of subphylum Myriapoda (Diplopoda, Chilopoda) in the various habitats in a region in North-eastern Bulgaria, which has been comparatively poorly studied – the Madara Plateau.

Materials and methods:

Region of research: The study was conducted in the region of the Madara Plateau, situated in North-eastern Bulgaria, in the southern part of the East Danubian Plain. Together with the Krivnensko Plateau, situated east of the Madara Plateau, they comprise the Royak Plateau, which is part of the protected area Provadiisko-Royaksko Plateau. The climate is moderate-continental characterized with comparatively cold winters and warm summers. The soil is carbonate, typical and leached chernozems, while the higher parts are defined by grey forest soil.

The Madara Plateau is situated in the eastern part of the Moesian forest vegetation area, lowland-foothill and foothill midmountain belt of oak forests (0-600 m a.s.l.).

The specific natural conditions of the Madara Plateau contribute to the development of rich and varied vegetation. There are over 95 woody shrub ecosystems in it (Donchev & Karakashev, 2012). The vegetation cover is characterized by a predominance of xerophilous and thermophilic elements that are prevalent in almost all parts of the plateau. They are represented mainly by ecosystems of *Carpinus orientalis* Mill., *Quercus pubescens* Willd., *Quercus cerris* Linnaeus, 1753, *Quercus frainetto* Ten., *Syringa vulgaris* L., and *Paliurus spina-christi* Mill., among others.

The mesophilic and mesothermal elements are more sparsely distributed. Their main representatives are *Carpinus betulus* Linnaeus, 1753, *Quercus robur* Linnaeus, 1753, *Tilia tomentosa* Moench, *Ulmus campestris* Mill., etc.

Sampling plots: The study was conducted on 11 sampling plots, located in the north-western part of the Madara Plateau, situated 12 km East of the town of Shumen, North-east Bulgaria (Fig. 1). The plots reflect the main ecosystems and include the major forest and open-space habitats on the Plateau. The altitude they were located at varies between 300 m and 450 m. The sampling plots differ in terms of the type and composition of plant formations in them:

MP1- coniferous forest of *Pinus nigra* of artificial origin; **MP2-** open meadow covered with wheat and steppe grass and sporadic shrubs; **MP3-** deciduous forest comprised of *Carpinus orientalis* shoots; **MP4-** open meadow with herbaceous vegetation and single shrubs and trees; **MP5-** deciduous-coniferous forest dominated by *Pinus sylvestris* and *P. nigra* with single members of *Tilia platyphyllos*, *Carpinus betulus*, *Quercus cerris* and *Betula pendula*, of

artificial origin; **MP6**- deciduous forest composed of *Q. cerris*, *C. betulus*, *Acer campestre* with single members of *T. platyphyllos* and *Fagus sylvatica*; **MP7**-coniferous forest composed of *P. nigra* (70%) and *P. sylvestris* (30%) of artificial origin; **MP8**-deciduous forest of *C. orientalis* (100%) shoots; **MP9**-deciduous forest dominated by *C. orientalis* (80%) and *C. betulus* (20%) shoots; **MP10**-deciduous forest of *C. orientalis* (100%) shoots and **MP11**-deciduous forest composed of *T. platyphyllos* (60%), *Fraxinus ornus* (10%), *A. campestre* (10%), *Q. cerris* (10%) and *C. betulus* (10%) shoots.

Collection of material: The material was collected through pitfall traps, 10 in each sampling plot, arranged in a straight line at a distance of 10 m from one another. The catch from the traps has been reported on a monthly basis in the period June 2012- February 2015.

The variety of species was estimated using the index of Shannon-Weaver (H') and the degree of equality using the index of Berger-Parker (d). β -diversity was determined through comparison between the myriapod communities collected from the different sampling plots using the quotient of similarity Czekanowski-Dice-Sørensen (Q_s) as well as using cluster analysis of the data on the quality content of myriapod fauna in the various habitats.



Fig. 1. Map of the area of research (in Google Earth format) and the distribution of the habitats under study

Results and discussion: The total of 3415 myriapods have been gathered in the period of research – 2776 millipedes and 639 centipedes. Up to the present moment the faunistic database of the myriapod fauna on the Madara Plateau includes a total of 28 species – 12 species of class Diplopoda, of 4 orders – Glomerida, Polydesmida, Chordeumatida and Julida and 16 species of the class Chilopoda of the orders Scutigleromorpha, Lithobiomorpha, Scolopendromorpha

and Geophilomorpha (Kaczmarek, 1970; Doichinov & Bachvarova, 2014; Krasteva et al., 2015).

The comparison of the two analysed classes of Myriapoda shows considerable differences in their diversity of species. Shannon-Weaver's index (H') for the millipede community (1,93) is higher compared to the one of the centipede community (1,30) (Table 1 A, B).

Table 1 A, B

α -diversity of the millipede (A) and centipede (B) communities on the Madara Plateau
A. Diplopoda

Species	Number of individuals	pi	ln pi	H'	d
<i>Glomeris balcanica</i>	31	0.011167147	-4.494779117	-0.050193859	3.478696742
<i>Glomeris hexasticha</i>	798	0.287463977	-1.246657724	-0.358369187	
<i>Polydesmus complanatus</i>	489	0.176152738	-1.736403832	-0.305872289	
<i>Polydesmus renschi</i>	19	0.00684438	-4.984327342	-0.034114632	
<i>Anamastigona bilselii</i>	13	0.004682997	-5.363816964	-0.025118739	
<i>Leptoiulus trilineatus</i>	270	0.097262248	-2.330344363	-0.226654531	
<i>Cylindroiulus boleti</i>	351	0.126440922	-2.067980098	-0.261477311	
<i>Megaphyllum bosniense</i>	365	0.13148415	-2.028868968	-0.266764111	
<i>Megaphyllum lictor</i>	73	0.02629683	-3.63830688	-0.095675937	
<i>Megaphyllum transsylvanicum</i>	336	0.121037464	-2.111655162	-0.255589386	
<i>Megaphyllum unilineatum</i>	1	0.000360231	-7.928766322	-0.002856184	
<i>Pachyiulus hungaricus</i>	30	0.010806916	-4.52756894	-0.048929059	
Total:	2776	1		1.931615226	

B. Chilopoda

Species	Number of individuals	pi	ln pi	H'	d
<i>Scutigera coleoptrata</i>	1	0.001564945	-6.459904454	-0.010109397	1.558536585
<i>Lithobius forficatus</i>	6	0.009389671	-4.668144985	-0.043832347	
<i>Lithobius lucifugus</i>	4	0.006259781	-5.073610093	-0.031759688	
<i>Lithobius mutabilis</i>	62	0.097026604	-2.332770069	-0.226340758	
<i>Lithobius muticus</i>	33	0.051643192	-2.963396893	-0.153039276	
<i>Lithobius nigripalpis</i>	72	0.112676056	-2.183238335	-0.245998686	
<i>Lithobius crassipes</i>	1	0.001564945	-6.459904454	-0.010109397	
<i>Lithobius microps</i>	1	0.001564945	-6.459904454	-0.010109397	
<i>Pleuroolithobius patriarchalis</i>	410	0.641627543	-0.443747295	-0.284720486	
<i>Scolopendra cingulata</i>	The species is not registered in the current study				
<i>Cryptops anomalans</i>	31	0.048513302	-3.02591725	-0.146797237	
<i>Himantarium gabrielis</i>	1	0.001564945	-6.459904454	-0.010109397	
<i>Clinopodes flavidus</i>	6	0.009389671	-4.668144985	-0.043832347	
<i>Stenotaenia linearis</i>	2	0.00312989	-5.766757274	-0.018049319	
<i>Henia illyrica</i>	2	0.00312989	-5.766757274	-0.018049319	
<i>Strigamia crassipes</i>	7	0.010954617	-4.513994305	-0.049449077	
Total:	639	1		1.302306126	

The millipede community is represented by species with comparatively high numbers. It is only the species *Megaphyllum unilineatum* and *Anamastigona bilselii*, registered with 1 and 13 individuals respectively, that feature low numbers. All other species, especially: *Glomeris hexasticha*, *Polydesmus complanatus*, *Leptoiulus trilineatus*, *Cylindroiulus boleti*, *Megaphyllum bosniense*, *Megaphyllum lictor*, and *Megaphyllum transsylvanicum* have high and comparatively similar numbers which attributes high degree of equality to the community and high values of the index of Berger-Parker (d) – 3,478 (Table 1 A).

The bigger part of the species comprising the centipede community feature very low (from 1 to 10 individuals) or average numbers (between 30 and 70 individuals). Only the species *Pleuroolithobius patriarchalis* has high numbers – 410 registered individuals which makes it the dominant species in the community. This considerable difference in the numbers of the species comprising the centipede community on the Madara Plateau attributes to the community a low degree of equality and small values of the index of Berger-Parker (d) – 1,558 (Table 1B).

α -diversity of the myriapod communities in the analysed habitats on the Madara Plateau is very different. The highest diversity of species ($H'=1,748$) and comparatively high degree of equality ($d=2,876$) are characteristic of the millipede community in the pine forest (MP7). In general, all forest habitats on the Madara Plateau are characterized with big α -diversity of the millipede communities where the index of Shannon-Weaver and the degree of equality are the highest (Table 2). The lime forest (MP11) and the open spaces (MP2 and MP4), which feature more xeric conditions, which are unfavourable to the development of the millipedes, particularly in the hot and arid summer months, are characterized with low biodiversity.

Table 2
 α -diversity of the millipede communities in the analysed habitats on the Madara Plateau

Sampling plot	Diversity index (H')	Equality index (d)
MP1– Coniferous forest	0.966073	1.39
MP2– Open meadow	1.433655	2.666667
MP3– Deciduous hornbeam forest	1.287368	1.808824
MP4– Meadow with steppe grass and scrubs	0.917194	1.346809
MP5– Mixed coniferous forest	1.316851	1.643777
MP6– Mixed deciduous forest	1.418084	2.548077
MP7– Pine forest	1.748316	2.876289
MP8– Deciduous hornbeam forest	1.088859	2
MP9– Deciduous hornbeam forest	1.516192	2.363636
MP10– Deciduous hornbeam forest	1.445034	3.058824
MP11– Lime forest	0.911658	1.894737

In general, the centipede communities in all analysed habitats are characterized with lower diversity of species and lower degree of equality compared to those of the millipedes (Table 3). As open areas are the preferred type of habitat for the centipedes, the analysed crest meadows (MP2 and MP4) feature the highest index of diversity ($H'=1,494$ and $1,308$ respectively) and degree of equality ($d=2,666$ and $1,747$). In contrast, the centipede communities in the forest habitats are characterized with low values of the index of Shannon-Weaver – $0,311$ for the mixed deciduous forest (MP6); $0,693$ for the lime forest (MP11) and $0,850$ for the coniferous forest (MP1). Due to the high number of the species *Pleurolithobius patriarchalis*, which is dominant in almost all sampling plots, the values of the index of equality of Berger-Parker are low.

Table 3

α –diversity of the centipede communities in the sampling plots on the Madara Plateau

Sampling plot	Index of diversity (H')	Index of equality (d)
MP1– Coniferous forest	0.850771	1.333333
MP2– Open meadow	1.494175	2.666667
MP3– Deciduous hornbeam forest	1.071018	1.7
MP4– Meadow with steppe grass and shrubs	1.308964	1.747253
MP5– Mixed coniferous forest	1.099627	1.602151
MP6– Mixed deciduous forest	0.311435	1.067164
MP7– Pine forest	1.275851	1.680556
MP8– Deciduous hornbeam forest	0.950271	1.666667
MP9– Deciduous hornbeam forest		
MP10– Deciduous hornbeam forest		
MP11– Lime forest	0.693147	2

The comparative analysis of the myriapod fauna in the analysed sampling plots shows that in the area of research, in terms of species composition, there are no fully identical habitats as the distribution of species on the one hand is determined by the potential species' carrying capacity of each habitat, the feeding grounds and the living conditions which they offer, while on the other hand, it reflects the specific biological abilities of the species to adapt and reproduce (Trojan, 1994). The level of similarity in the composition of millipede communities on the Madara Plateau varies widely. Sørensen's gradient is lowest between the lime forest (MP11) and the coniferous forest (MP1) – $0,44$ but it reaches almost maximum values when comparing the deciduous hornbeam forests (MP6 and MP3 – $0,92$ and MP6 and MP10 – $0,91$) (Table 4).

Table 4

Values of the gradient of Czekanowski-Dice-Sørensen (Qs)
for the millipede communities in the analysed habitats on the Madara Plateau.

Sampling plot	MP1	MP2	MP3	MP4	MP5	MP6	MP7	MP8	MP9	MP10	MP11
MP1	1										
MP2	0.91	1									
MP3	0.77	0.83	1								
MP4	0.63	0.53	0.71	1							
MP5	0.63	0.53	0.71	0.9	1						
MP6	0.67	0.73	0.92	0.75	0.75	1					
MP7	0.63	0.53	0.71	0.9	0.9	0.75	1				
MP8	0.6	0.67	0.73	0.57	0.57	0.8	0.57	1			
MP9	0.5	0.55	0.77	0.75	0.75	0.83	0.75	0.8	1		
MP10	0.55	0.6	0.83	0.67	0.67	0.91	0.67	0.67	0.73	1	
MP11	0.44	0.5	0.6	0.46	0.46	0.67	0.46	0.86	0.67	0.75	1

The highest quotient of similarity is registered between the millipede communities in the coniferous and mixed coniferous-deciduous forests with the open habitats on the plateau. Sørensen's quotient is 0,91 for the coniferous forest of *P. nigra* (MP1) and the open crest meadow (MP2), where 5 out of the total of 11 registered species are common for both sampling plots. The quotient shows such high values (0,90) when comparing the mixed coniferous-deciduous forest MP5, dominated by *P. sylvestris* and *P. nigra* to the coniferous forest MP7, as well as these two to the open crest meadow MP4. These are the sampling plots characterized with highest abundance of species. This high degree of similarity between habitats which greatly differ in their flora component and food base is probably due to the nearly identical environmental conditions they offer. This fact coincides with the research carried by Kime et al. (1992) in Belgium which proved that the distribution of soil organisms depends most of all on the climatic and edaphic environmental factors – soil structure, its water and mineral content, the type of humus and temperature. The habitats mentioned above are characterized with more xeric conditions and very poor trophic base mostly due to the absence of typical deciduous forest leaf litter. They offer a very harsh living environment during the hot and arid summer months and are inhabited mostly by evritopic and polytopic species which adapt to these living conditions thanks to various devices – ability to fold and bury themselves in the leaves and the soil, waterproof body coverings, a special type of respiratory apparatus, and the ability to move to adjoining territories, among others. These species belong to the “bulldozer” ecomorphological type according to the classification offered by Hopkin & Read (1992) and Gruner et al. (1993), which allows them to penetrate very hard soils freely and to migrate to a considerable depth. Most of these species have cuticle structures heavily coated with calcium and magnesium carbonate which prevents the body from the evaporation of water. The results fully correspond to the data collected from the research on the myriapod fauna on the Madara Plateau where

the highest quotient of similarity of millipede communities is also shown by the habitats which offer the most xeric conditions (Bachvarova et al., 2015).

The comparison of deciduous forest habitats also registers high degree of similarity in the species composition of the millipede communities. The similarity quotient of Czekanowski-Dice-Sørensen fluctuates from 0,73 between sampling plots MP10 and MP9 and reaches 0,83 for MP9 and MP6.

The lowest similarity is registered between the millipede communities inhabiting deciduous forest habitats and the coniferous forests and the open crest meadows (Table 4).

The millipede fauna in the analysed area features comparatively high quotient of similarity in the separate sampling plots. It is divided into three main groups, two of which are formed by the more xeric habitats – the open crest meadows and the coniferous forests, and the third one is formed by the habitats dominated by *Carpinus orientalis* (Fig. 2).

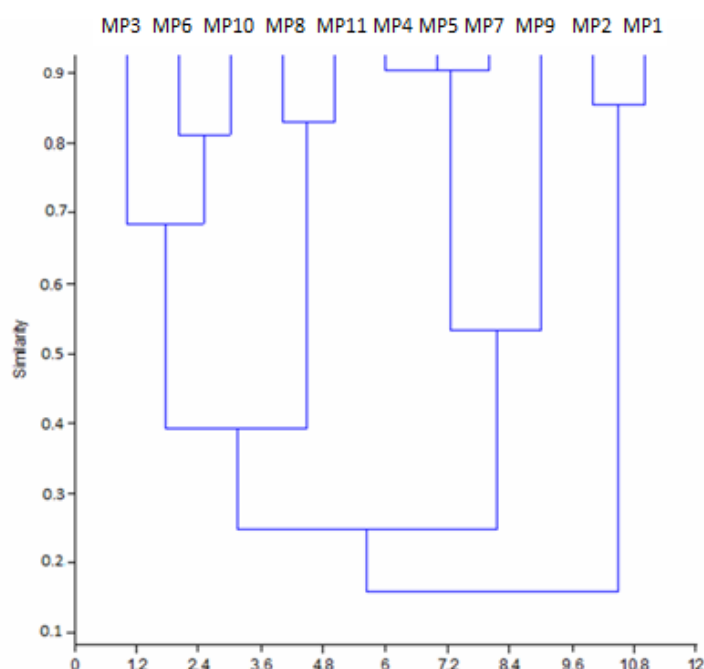


Fig. 2. Dendrogram of the similarity in composition of the species in the millipede communities in the analysed habitats on the Madara Plateau.

The group of the open crest meadow (MP4) and the mixed deciduous-coniferous forest (MP5) and the pine forest (MP7) stand out with the highest quotient of similarity (90%). The deciduous forest of *C. orientalis* (MP9) joins this group. This weird similarity between unusual habitats is most likely due to the fact that these sampling plots feature a very steep gradient (10^0) and are characterized with very poor, rocky and heavily leached soils with low water retention properties, making them the most xeric habitats of the deciduous forests. Sampling plot MP2, located in the second open meadow and the pine

forest composed of *P. nigra* (MP1) form the other group of xeric habitats with a quotient of similarity of 83%. In the group of the deciduous forests there are two tandems with a comparatively equal quotient of similarity of around 82-83% that are formed. The first tandem is comprised of sampling plots MP6 and MP10, and the second one of MP8 and MP11 featuring Sørensen's quotient of 0,91 and 0,86 respectively.

These three groups correlate at a very low quotient of similarity (17%) which is an indication of the very high specialization of the millipedes to the composition of plant formations and the ecological conditions of the habitat.

In general, the centipede fauna in the analysed area shows a very low quotient of similarity compared to that of the millipedes. The values of the quotient of Sørensen move within very wide range – from 0,17 of the lime forest (MP11) and the mixed deciduous-coniferous forest (MP5) to very high values (0,89) obtained at the comparison of the mixed deciduous-coniferous forest – MP5 and the coniferous forest of *P.sylvestris* and *P. nigra* – MP7 (Table 5).

Comparing 4 of the sampling plots – MP9 to MP1, MP9 to MP2, MP11 to MP9, and then all sampling plots to MP10 there are no common species that are found, whereby the quotient of Sørensen equals 0,00. Generally, the species composition of the centipede community in the lime forest (MP11) shows the lowest degree of similarity when compared to all other habitats (Table 5).

Table 5

Values of the quotient of Czekanowski-Dice-Sørensen (Qs)
for the centipede communities in the analysed habitats on the Madara Plateau.

площадка	MP1	MP2	MP3	MP4	MP5	MP6	MP7	MP8	MP9	MP10	MP11
MP1	1										
MP2	0.8	1									
MP3	0.67	0.67	1								
MP4	0.57	0.57	0.62	1							
MP5	0.53	0.53	0.57	0.63	1						
MP6	0.4	0.6	0.44	0.57	0.53	1					
MP7	0.46	0.46	0.5	0.59	0.89	0.62	1				
MP8	0.25	0.25	0.29	0.33	0.46	0.75	0.55	1			
MP9	0	0	0.4	0.2	0.18	0.33	0.22	0.5	1		
MP10	0	0	0	0	0	0	0	0	0	1	
MP11	0.57	0.29	0	0.18	0.17	0.29	0.2	0.4	0	0	1

The centipede communities in the analysed area are divided into two main groups at a quotient of similarity 46% (Fig. 3).

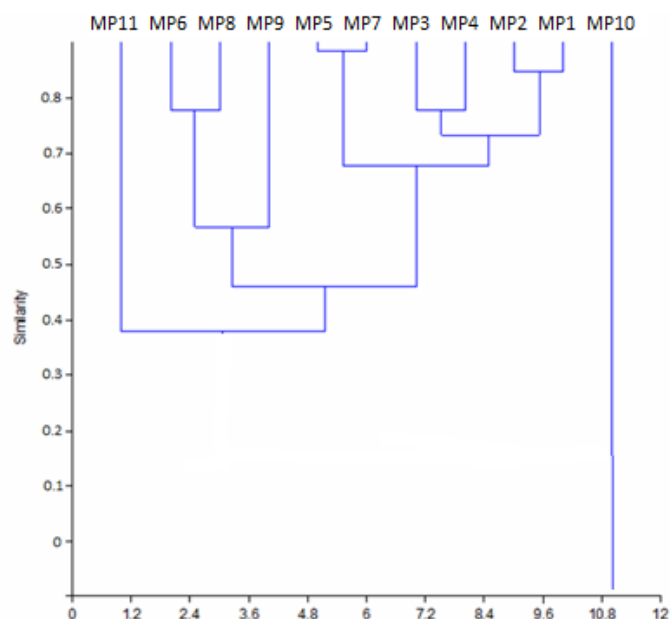


Fig. 3. Dendrogram of the similarity in composition of the species in the centipede communities in the analysed habitats on the Madara Plateau.

They strongly resemble the clusters of the millipede communities – the first one of them is formed by the deciduous forests, while the other, which is much richer, by the more xeric habitats. Once again, the two sampling plots: MP5 – the mixed deciduous-coniferous forest and MP7 – the coniferous forest of *P. sylvestris* and *P. nigra*, show the highest degree of correlation (90%). The second group of the xerophilic habitats – the open meadow (MP2) and the coniferous forest dominated by *P. nigra* (MP1) is formed at a quotient of similarity of 85%, while the open crest meadow – MP4 and the hornbeam forest – MP3 form the third domain at a quotient of similarity of 78%.

The group of the deciduous forests is formed by the hornbeam habitats of sampling plots MP6 and MP8 which correlate at 78%, and at correlation of 57% sampling plot MP9 joins them. The lime forest (MP11) is with the lowest quotients of similarity and a degree of correlation 38%.

In general, the myriapod fauna on the Madara Plateau is characterized with a comparatively poor species composition – 28 registered species of myriapods in all analysed habitats. In comparison, only in the reserve Bukaka, located in Natural Park Shumen Plateau, there have been registered 29 species (Bachvarova, 2011). Most probably this is as a result of the strong human presence and active agricultural activity on the Madara Plateau. The biggest diversity of species of both classes of Myriapoda in the region of Shumen is registered in the suburban area of park Kyoshkovete with 17 species of Diplopoda and 20 species of Chilopoda (Bachvarova, 2011), a fact which to a considerable degree confirms the trend of increase in the diversity of species in conditions of weak anthropogenic pressure as ascertained by some scholars

(Vepsäläinen & Wuorenrinne, 1978; Trojan, 1981; Schaefer, 1982; Kuznetzova, 1994).

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References:

- [1]. Bachvarova, D. 2011. Myriapoda (Chilopoda, Diplopoda) of Shumen City and Shumen Plateau (NE Bulgaria): Taxonomic Structure and Zoogeographical Analysis. *Acta zoologica bulgarica*, 63 (3): 245-262.
- [2]. Bachvarova, D., A. Doichinov, Ch. Deltchev and P. Stoev. 2015. Habitat distribution of myriapods (Chilopoda, Diplopoda) in the town of Shumen and Shumen Plateau (NE Bulgaria), // *Arthropoda Selecta*, 24(2), pp.169-184.
- [3]. Doichinov A., D. Bachvarova, 2014. Contribution to the research on Myriapods (Chilopoda, Diplopoda) in the Madara Plateau, Shumen region, North-Eastern Bulgaria, // Proceedings of the "Seminar of Ecology - 2014" with international participation, 2014, pp. 27-36.
- [4]. Donchev, D., Ch. Karakashev, 2012. Geography of Bulgaria. Sofia, "Siela", 640 pp. (in Bulgarian)
- [5]. Gruner, H. E., Mortz, M., Dunger, W. 1993. Wirbellose Tiere. 4 Teil: Arthropoda (ohne Insecta). Lehrbuch der Spezielle Zoologie. I: Jena, Stuttgart, New York: G. Fischer Verlag.
- [6]. Hopkin, S. P., Read, H. 1992. The biology of millipedes. Oxford University Press, Oxford – New York – Tokyo, 234 pp.
- [7]. Kaczmarek, J. 1970. Beiträge zur Kenntniz bulgarischer Chilopoden. Teil III. *Bulletin de la Société des amis des sciences et des letters de Poznan*, Sér. D, 11: 81-89.
- [8]. Kime, R. D., Wauthy, G., Delecour, F., Dufrêne, M., Drugmand, D. 1992. Distribution spatiale et préférences écologiques chez les Diplopodes du sol. *Mémoires de la Société royale belge d'Entomologie*, 35: 661- 670.
- [9]. Krasteva, D., D. Bachvarova, A. Doichinov, 2015. Contribution to the research on the taxonomic structure of Myriapoda (Chilopoda, Diplopoda) of Madara Plateau, North-Eastern Bulgaria, // Proceedings of the Third student scientific conference "Ecology and environment", Konstantin Preslavsky University Press, Shumen, 2015, Volume 2, pp. 74-87.
- [10]. Kuznetzova, N. 1994. Collembolan guild structure as an indicator of tree plantation conditions in urban areas. *Memorabilia zoologica*, 49: 197-205.
- [11]. Schaefer, M. 1982. Studies on the arthropod fauna of green urban ecosystems. *Blackwell Scientific Publications*, Oxford – London – Edinburg, 65-73.
- [12]. Trojan, P. 1981. Urban fauna: faunistic, zoogeographical and ecological problems. *Memorabilia zoologica*, 34: 3-12.
- [13]. Trojan, P. 1994. The shaping of the diversity of invertebrate species in the urban green spaces of Warsaw. *Memorabilia zoologica*, 49: 167-173.
- [14]. Vepsäläinen, K., Wuorenrinne, H. 1978. Ecological effects of urbanization on the mound-building *Formica* L. species. *Memorabilia zoologica*, 29: 191-202.



FREQUENCY OF BLOOD TYPES FROM SYSTEMS AB0 AND RHESUS FACTOR IN PATIENTS WITH CARCINOMA OF THE VAGINAE

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ABSTRACT: *The research included 115 female patients with carcinoma of the vagina (Ca vaginae). Their blood types belonging to the systems AB0 and Rhesus factor were studied. Comparing the control group of Bulgarian population statistically significant differences in the distribution of all types of AB0 system were detected. The increase in blood type A (with 23, 26% - to 66, 96%) and the decrease in blood type 0 (with 18, 54% - to 19, 13%) are especially obvious. There is no difference in Rh system. It can be assumed that having blood type A appears to be one of the risk factors for the emergence and development of the disease in the female patients.*

KEY WORDS: *blood types systems AB0 and Rhesus factor, Ca vaginae*

A significant part of our research on blood types of systems AB0 and Rhesus factor is connected to the emergence and development of a number of diseases. Particular attention is paid to malignant neoplasms. In this regard and diseases of the breast and female genital organs are tracked - Ca glandulae mammae, Ca uteri, Ca ovarii [1], Ca vulvae [2]. Their emergence and development as well as other neoplasms may be associated with a number of factors. Hereditary predisposition, the way of life and the influence of environmental factors are considered fundamental. Hereditary predisposition is not normally associated with particular biological characteristics. Maybe we should be looking, albeit indirectly, for the relationship of neoplasms with blood types belonging to systems AB0 and Rhesus factor.

Aim of the study: To examine the relationship between the emergence and development of Ca vaginae with female patients' blood types belonging to systems AB0 and Rhesus factor.

Material and methods:

The present study included 115 female patients with Ca vaginae. They were diagnosed with the disease and treated in the oncology ward of Fifth City Hospital in Sofia and the National Hospital Oncology in Sofia in the period 1990-2014. Their blood types from systems AB0 and Rhesus factor were studied. The patients' blood types and Rhesus factor were identified by means of test serums. The results have been compared to the data of excerpt of Bulgarian population [3]. The comparison was made via the χ^2 criterion.

Results and discussion

The data of the study are presented in table 1 and figure 1 and 2.

Table 1. Frequency of the blood types from systems AB0 and Rhesus factor in patients with Ca vaginae and the control group (%)

Blood types		O	A	B	AB	Rh+	Rh-
Patients with Ca vaginae n 115	n	22	77	14	2	103	11
	%	19,13	66,96	12,17	1,74	90,43	9,57
Control group n 1080	n	342	472	184	82	916	164
	%	31,67	43,70	18,06	7,59	84,81	15,19

AB0 system

The frequencies of included female patients' blood types are as follows: for group O – 19,13%, for group A – 66,96%, for group B – 12,17% and for group AB – 1,74%. Distinct differences are observed when comparing the distribution of the blood types in control excerpt [3], in which the data is: group O – 31,67%, group A – 43,70%, group B – 18,06% and group AB – 7,59%. In group A reported a strong increase with 23,26% to 66,96%. Decrease in the values in the other group is detected, though in varying degrees: in group O – with 13,54% to 19,13%, in group B – with 5,89% to 12,17% and in group AB – with 5,85% to 1,74%. Significant differences are observed about the cross section as a whole in comparison to the control section ($K=3$; $\chi^2=11,3$; $p<0,001$) – table 1, figure1.

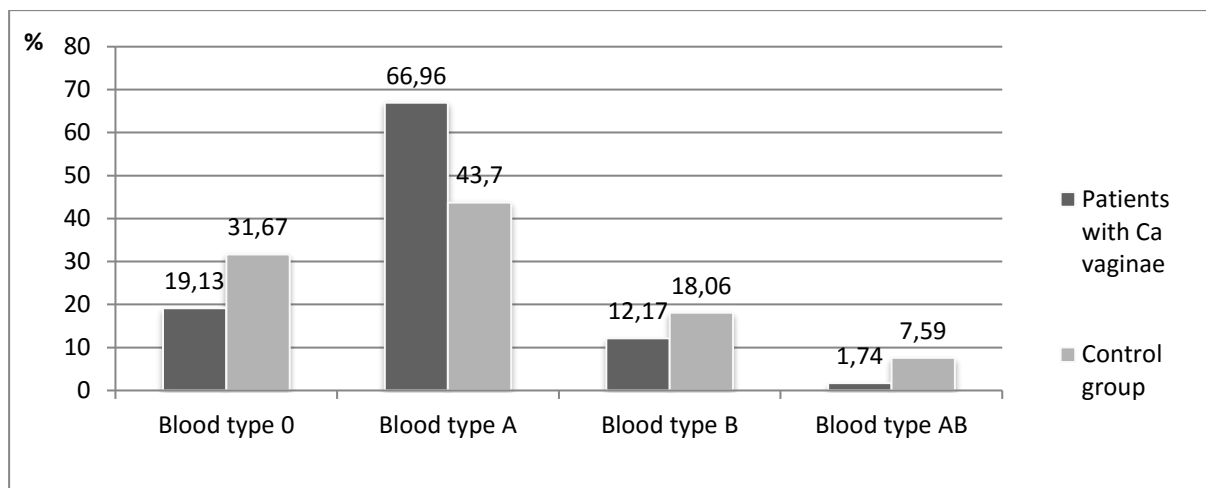


Figure 1. Frequency of the blood types from system AB0 in patients with Ca vaginae and the control group (%)

Rhesus factor system

The results received with the patients are: for Rh(+) - 90,43 and for Rh (-) - 9,57%. The comparison with the frequencies of the values of Rh in the control group - Rh (+) - 84,81% and Rh (-) - 15,19% [3], show a definite decrease in the values of Rh (-) of 5,62%. The differences were not significant ($K=1$; $\chi^2=3,3$) – table 1, figure 2.

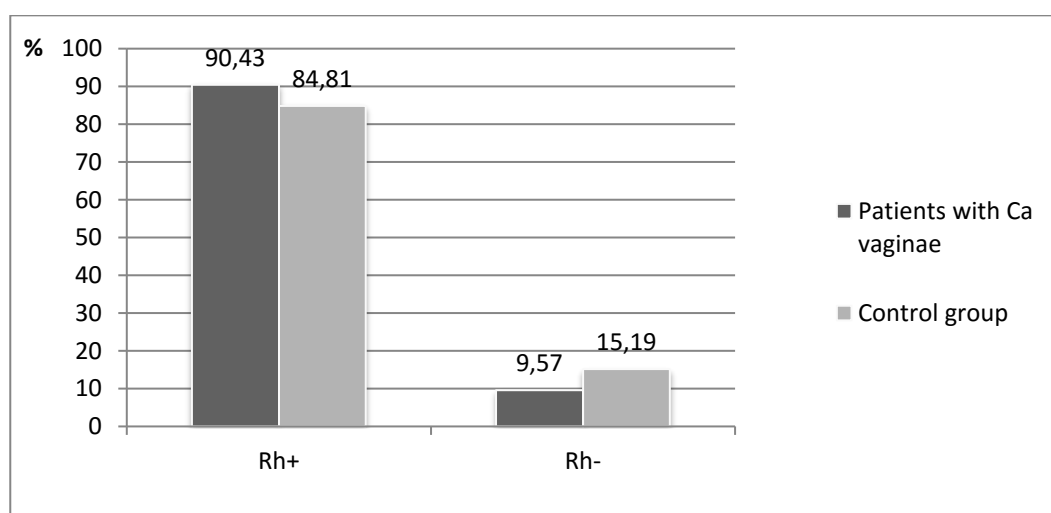


Figure 2. Frequency of the blood types from system Rhesus factor in patients with Ca vaginae and the control group (%)

This study examined the connection between blood group belonging to systems AB0 and Rh factor and probability of emergence and development of another of malignancy of the female genital organs – Ca vaginae. The reason for this is the received results so far of Ca glandulae mammae, Ca uteri, Ca ovarii and Ca vulvae, which were monitored.

Ca vaginae is a relatively rare disease of the female reproductive organs. In our country it occurs in 0,10 / 100000 people and accounts for 0,2% of all malignant diseases of the Bulgarian population [4]. It is less common than the other tested by us: Ca glandulae mammae - 2,73 / 100000 or 12,9%, Ca uteri - 61,4 / 100 000 or 16,2%, Ca ovarii - 2,62 / 100000 or 5,3% [1], and Ca vulvae - 2,60 / 100,000 or 0,70% [2].

Most often this disease occurs in older women (postmenopausal), but also though very rarely, in younger women [5] - in our study in a 18-year-old female patient.

Histologically, the onset of carcinoma is due to disturbances in the flat epithelial cells constituting the surface layer of the vaginal mucosa [6]. The cause of this cancer is not known, but there are suggestions that this could be a human papillomavirus and basic types 16 and 18. The emergence of dysplasia may not last long, but malignancy appears increasingly [5]. Particular attention should be paid to the leukoplakia, the thickening, infiltration, nodes and ulcerosa [6]. Excessive malignancy may be due to the close proximity of the organ with a rich network of lymphatic vessels [6].

In Ca vaginae can be identified three macroscopic forms [5]:

1. Ekzofiten - grows towards the lumen of the body;
2. Ulcerative - developed in depth;
3. Eroded - nascent on the surface and in depth, increasingly deep layers.

According to the scope of the process the following clinical stages can be determined [6].

1. Only in the rear wall of the vagina;
2. It covers tissues and around the vagina, without reaching the wall of the pelvis;
3. Reaches the walls of the pelvis;
- 4a. It covers the wall of the bladder and the rectum and possibly extends beyond the pelvis;
- 4b. The process of metastasis extends to distant organs.

When the disease is detected, it is usually too late for successful treatment. In this connection, regular gynecological examinations (especially

after menopause) are recommended, allowing early diagnosis [6]. The difficulties come from undetected symptoms as malignancy is located in the epithelium [5].

Treatment in early stages is through surgery. In later stages, apply radiotherapy - percutaneous radiotherapy and brachytherapy. In all cases, the prognosis is for bad outcome, due to the nature of the disease, leading to infiltration into adjacent organs and the development of metastases [6].

A significantly higher incidence of blood group A compared with the control group is reported in most of the tumors of the female genital organs we studied: Ca ovarii - 49,55%, $p < 0,01$; Ca uteri - 49,55%, $p < 0,01$; Ca glandulae mammae - 48,33%, $p < 0,01$. Only in Ca vaginae was noted significantly greater prevalence of blood group 0 - to 47,42%, $p < 0,05$.

In none of the researched diseases of the system Rhesus factor have significant differences been reported in comparison to the control group. Frequencies in Ca uteri and Ca glandulae mammae [1] are almost identical to those of the control. In Ca vulvae are recorded lower values for Rh(-) 3,75%[2].

In patients with the Ca vaginae significant changes of individual groups of the AB0 system are found in comparison with the control group. Above all, a significant increase is detected in the value of blood type A. This fact gives grounds to assume that there is a certain correlation between this blood type and the emergence and development of the disease. Probably belonging to this group is one of the risk factors (predisposition) of the emergence of this cancer.

Conclusions:

1. The distribution of blood types of AB0 system in patients with Ca vaginae differs significantly ($p < 0,001$) from that of the control group. This is mainly due to the very high levels of blood type A – 66,96%.
2. We assume that belonging to blood types A is one of the risk factors for the onset and development of Ca vaginae.

References:

- [1]. Maksimova, S., V. Todorov, A. Timcheva. Sistemi krvnih grupa ABO i Rezus factor kod nekih oboljenja od socijalnog značaja, Journal of the anthropological society of Jugoslavia, 1997, 33, p. 119-124.
- [2]. Todorov, V., S. Maksimova. Krvnogrupalni sistemi ABO i Rh factor kod pacijenta sa karcinomom vulvae, Glasnik antropoloskog drustva Srbije, 2011, 46, p. 179-181.

- [3]. Todorov, V. Promene antropoloških karakteristika u toku starenja, Doctorate thesis, Belgrade, 1998-1999, p. 72-77.
- [4]. Dimitrova, N., M. Vukov, M. Valeriev. Cancer condition in Bulgaria - 2011. National oncology hospital, 2013, 22, 60 p.
- [5]. Tontcheva, K. C., L. Krasteva, V. Tsekova. Ca vaginae, Medical Oncology, Paradox, 2012, p. 115-119.
- [6]. Rudolf, Sv. Ca vaginae, Dysplasia vaginae. Onkologija, Medicinski fakultet Beograd, 2009, p. 205-216.

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MAGNETO-OPTIC STUDY OF CHROMIUM DOPED $\text{Bi}_{12}\text{SiO}_{20}$

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ABSTRACT Faraday rotation in $\text{Bi}_{12}\text{SiO}_{20}:\text{Cr}$ (BSO:Cr) has been investigated on (100) direction at room temperature using refractive index data in the spectral region 700 – 850 nm. Verdet constant (V) spectrum is determined in the same spectral region for this crystal. The Verdet constant spectrum of pure BSO can be described by the linear dependence $V^{-1}(\lambda^2)$ (λ is the wavelength of the light). The Cr-ions in the sillenite crystal lattice cause a deviation of Verdet constant from the mentioned linear dependence in the spectral region of the absorption impurity structure. The magneto-optic anomaly factor γ is also investigated.

KEY WORDS: 3d transition metals, Faraday rotation, Verdet constant, magneto-optic anomaly factor

INTRODUCTION

Bismuth oxide compounds such as the sillenite-type $\text{Bi}_{12}\text{MO}_{20}$ (BMO, where $M = \text{Si, Ge, Ti}$) crystals are being extensively studied because of their potential applications including dynamic holography, optical information processing, optical phase conjugation and real-time interferometry [1–5]. The defect identification, including the dopant ions involved, their valence and local symmetry is essential because this information may guide the efforts for optimization of the synthesis conditions to obtain the intended material properties. The dopants in the sillenite crystals form the subband of the deep or shallow impurity levels in the forbidden band. This fact leads to the manifestation of paramagnetic or diamagnetic properties of the doped sillenite in magnetic field.

In this paper, we present a detailed magneto-optic study of the paramagnetic behavior of Cr ions in doped $\text{Bi}_{12}\text{SiO}_{20}$ in the spectral region 700 – 850 nm.

MATERIALS AND SAMPLES PREPARATION

$\text{Bi}_{12}\text{SiO}_{20}$ crystals belong to the sillenite family of materials with the space symmetry I23 with a body centered cubic unit cell ($a = 10.102 \text{ \AA}$), which contains 24 Bi^{3+} ions, 2 Si^{4+} ions and 40 O^{2-} ions (nominal valences). Two structural elements can be distinguished, the SiO_4 regular tetrahedron and the BiO_7 polyhedron [6]. The former exists at the corners and at the center of the cubic unit cell. In the BiO_7 polyhedron, each of the Bi^{3+} ions is surrounded by 7 oxygen atoms and is coordinated in a pseudo-octahedral configuration, in which the oxygen atom at one corner is replaced by two atoms at somewhat larger distance. BSO single crystals were grown in air by the Czochralski method from a melt containing a mixture of high purity (99.9999%) oxides including Bi_2O_3 and SiO_2 in a 6:1 molar ratio [7]. Platinum crucibles of 60 mm in diameter and 80 mm in height were used as containers. The crystals were grown in a $\langle 001 \rangle$ direction under conditions of low temperature gradient over the solution (5–7 °C/cm), at a growth rate of 0.7 mm/h and a rotation rate of 20 rpm. Fully faceted and optically homogeneous crystals of 35 mm in diameter and 50 mm in height were obtained. The starting chromium dopant was introduced into the melt solution in the form of the oxide Cr_2O_3 . The analysis by atomic absorption spectrometry shows that they are present in the crystal at concentration of $[\text{Cr}] = 4.9 \times 10^{18} \text{ cm}^{-3}$. This corresponds to relative concentration $[\text{Cr}]/[\text{Si}] = 0.25\%$.

EXPERIMENTAL RESULTS AND DISCUSSION

The magneto-optic Faraday effect presents the connection between optics, magnetism and atomic physics. The effect occurs when the rotation of a linearly polarized wave passes through a thickness of a transparent medium. However, rotations of polarized light are not only limited to optically active materials, but also including some optically inactive materials exposed to high magnetic field. In magnetized medium the refractive indices for right- and left-handed circularly polarized light are different. The precession of the angular momentum of an electron orbiting the nucleus leads to different indices of refraction for rightly or leftly polarized light. This leads to a rotation of plane polarized light. The rotation angle φ and refractive index n are related by the formula [8]:

$$\varphi = \frac{\pi \varepsilon_2}{\lambda n} d. \quad (1)$$

The magneto-optic anomaly factor γ can be taken as a measure of the degree of covalency that exists in the bonds connecting the ions and atoms [9].

$$\gamma = \frac{\varphi}{\frac{e}{2mc^2} \lambda D} \quad (2)$$

In the paramagnetic materials, the anomaly factors γ can vary with the wavelength of the incident light, even if there is only one a absorption frequency contributing to dispersion. The dispersivity of the investigated crystal can be presented by the following equation:

$$D = -\frac{\lambda}{c} \frac{d^2 n}{d\lambda^2}. \quad (3)$$

The magneto-optic rotation in many crystals, glasses and solutions is expressible by the Becquerel's formula [10]:

$$V = \gamma \frac{e}{2mc^2} \lambda \frac{dn}{d\lambda}. \quad (4)$$

Equation (2) is substituted in equation (4) after the substitution of formulas (1) and (3) in (2). The final result is formula (5):

$$V = -\frac{cd\alpha}{2\lambda} \frac{dn}{d\lambda^2} \frac{d\lambda}{d\lambda^2}. \quad (5)$$

The anomaly factor γ_{ion} for the chromium ions is calculated from the equation [10]:

$$\gamma_{ion} = \frac{[\Omega_i]_M}{\frac{e}{2mc^2} \lambda [D_i]_M}. \quad (6)$$

The equation (7) is obtained from formulas (4) and (6).

$$\frac{[\Omega_i]_M}{[D_i]_M} = \left[\frac{V}{\frac{dn}{d\lambda}} \right] \quad (7)$$

The spectral dependence $n(\lambda)$ of chromium doped BSO is presented in figure 1. The dependence $1/\varphi(\lambda^2)$ is shown in figure 2. The Verdet constant as a function of wavelength λ is obtained in figure 3. The magneto-optic anomaly factor γ and the dependence $[\Omega_i]_M/[D_i]_M(\lambda)$ are presented respectively in figures 4 and 5. All values of the Verdet constant are negative in the investigated spectral region. This is the proof for the manifestation of paramagnetism of the chromium in doped $\text{Bi}_{12}\text{SiO}_{20}$ [11]. The covalency of the bonds Cr-O in the oxygen substructures of doped crystal changes constantly in the spectral region 700-850 nm. The attitude $[\Omega_i]_M/[D_i]_M$ as a function of wavelength λ shows the anisotropy of chromium rotativity and dispersivity.

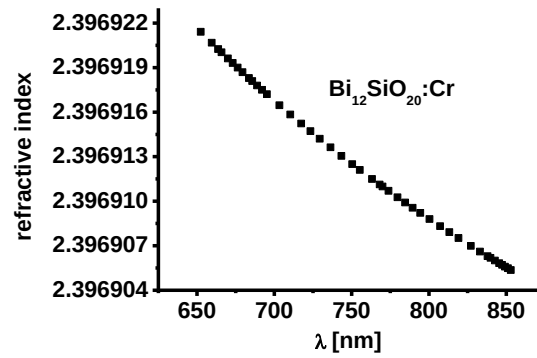


Figure 1 The refractive index n of $\text{Bi}_{12}\text{SiO}_{20}:\text{Cr}$ in the spectral region 700 – 850 nm.

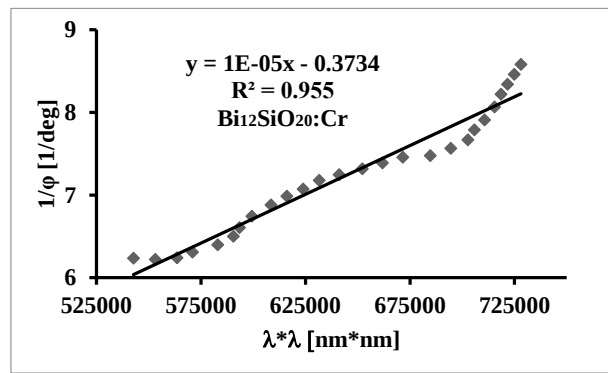


Figure 2 The linear dependence $1/\phi$ [deg⁻¹] for $\text{Bi}_{12}\text{SiO}_{20}:\text{Cr}$ in the spectral region 700 – 850 nm.

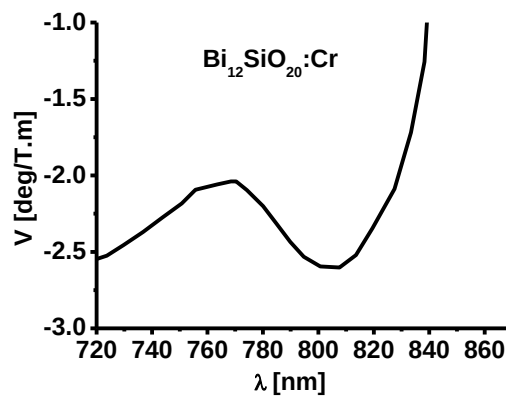


Figure 3 The Verdet constant for $\text{Bi}_{12}\text{SiO}_{20}:\text{Cr}$ in the spectral region 700 – 850 nm.

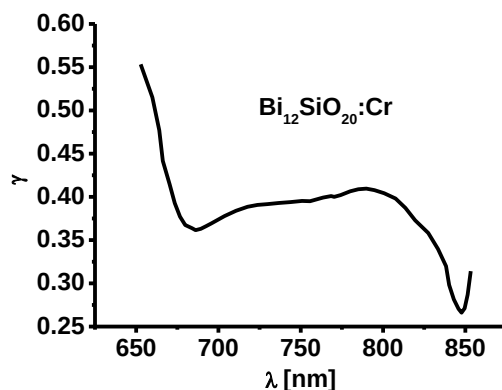


Figure 4 The magneto-optic anomaly factor γ for $\text{Bi}_{12}\text{SiO}_{20}:\text{Cr}$ in the spectral region 700 – 850 nm.

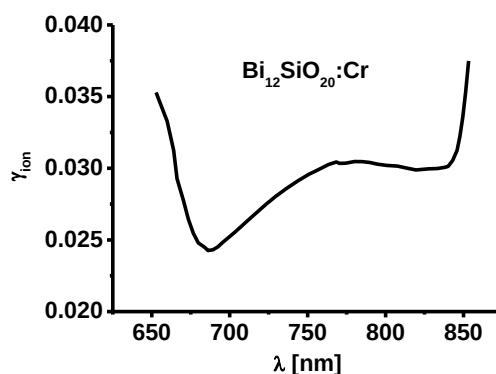


Figure 5 The attitude of the molecular rotativity $[\Omega_i]_M$ and the molecular dispersivity $[D_i]_M$ as a function of wavelength λ for $\text{Bi}_{12}\text{SiO}_{20}:\text{Cr}$.

CONCLUSIONS

In this work, we have been obtained the anomaly dispersion of magnetic rotation (ADMR) of chromium ions in doped $\text{Bi}_{12}\text{SiO}_{20}$. As it is known, ADMR is connected with the nature of electron levels of ions and their configuration and conformation. In this connection, the next step of our investigation is in this direction. As it is known, the Faraday effect due to paramagnetic ions is much stronger than that of diamagnetic lattice with the size of the effect strongly dependent on the choice of the paramagnetic ions and their density in the material. This choice is very important for the future applications of the investigated doped materials. Therefore we will continue to study their magneto-optical properties.

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REFERENCES

- [1]. Y. H. Ja, Opt. Commun. 42, 377 (1982).
- [2]. M. P. Georges, V. S. Scaufaire, and P. C. Lemaire, Appl. Phys. B 72, 761 (2001).
- [3]. E. A. Barbosa, R. Verzini, and J. F. Carvalho, Opt. Commun. 263, 189 (2006).
- [4]. M. R. R. Gesualdi, D. Soga, and M. Muramatsu, Opt. Laser Technol. 39, 98 (2007).
- [5]. E. A. Barbosa, A. O. Preto, D. M. Silva, J. F. Carvalho, and N. I. Morimoto, Opt. Commun. 281, 408 (2008).
- [6]. [6] S. C. Abrahams, J. L. Bernstein, and C. Svensson, J. Chem. Phys. 71, 788 (1979); S. C. Abrahams, P. B. Jamieson, and J. L. Bernstein, *ibid.* 47, 4034 (1967).
- [7]. P. Sveshtarov and M. Gospodinov, J. Cryst. Growth 113, 186 (1991).
- [8]. Enzyme Physics, M.V. Vol'kenshtein, Springer Science + Business Media, LLC, 1969
- [9]. Magneto-optic study of some inorganic acids and their salts, V. Sivaramakrishnan, 1954
- [10]. Dispersion of Faraday rotation in some optical glasses, V. Sivaramakrishnan, 1956
- [11]. J.E. Shelby, Introduction to glass science and Technology, New York, USA, 2005



A RESEARCH STUDY ON KONSTANTIN PRES LAVSKY UNIVERSITY OF SHUMEN STUDENTS` REALIZATION

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Abstract: The paper presents the opinions of users, specialists and students who study at Konstantin Preslavsky University of Shumen. The period involved is 2009-2013. The paper analyzes the collected, processed and systematized data from two of the four questionnaires used by Shumen University – Questionnaire A3 for quality of education that is intended for employers and Questionnaire A4 that is intended for students who graduate Shumen University. <http://uninet.shu-bg.net/upravlenienakachestvoto/anketi/>

Keywords: quality education of students, insurance system, maintenance and development of the quality of education, labor market and students` realization.

Introduction

The marketing researches on the labour market are key elements from the Quality Management System in Shumen University. The Career Centre and lecturers who know the capabilities of companies and state institutions in the region to employ graduates carry out jointly these surveys.

The professional fields in the main structural units also support continuous and effective contacts with employers. These are in the form of meetings, discussions, consultations, assessments and recommendations. The aim is to allow educational practices and internships in a real professional environment; to enhance mediation in the process of searching work from students and graduates.

Analysis of the results of the polls

The research on the *labor market status* and *trends* involves:

- Assessment of staff needs within the labor market in order to optimize the academic profile of Shumen University;
- Improvement of quality of education – to specify the knowledge, skills and competences required according to the market rules;
- Enhancement of opportunities for students` realization.

The users` profile is determined and recorded in several ways:

- by direct contact with representatives and experts from leading companies and public institutions and by discussion of opportunities for internships and practical training of students. Moreover, it is also discussed the environment in which business works and its requirements to students` training;
- by collaboration with regional employment offices, Directorates of Labour, „Students` Work” units and other units of the Employment Agency;
- by periodic surveys of representatives of companies, institutions and organizations, including Regional inspectorates of education and other state institutions.

The following table provides information on the range of interviewers in respect to different institutions involved and different profiles of personnel required:

Table 1 Interviewed Employers according to the Type of Institution (2009-2013)

Institution/Company/Organization	Number Interviewers
Regional Inspectorates of the Ministry of Education	28
Companies	47
Eparchies	15
Primary Schools	32
Kindergartens	41
Secondary Schools	122
Sports Schools	6
VIIIth Grades Schools	254
High Schools, Vocational Schools and Specialized Schools	125
Special Schools	10
Total	680

Shumen University establishes and maintains *effective contacts with employers* to ensure successful training and professional development of its graduates. There are also close links with experts from ministries and other departments, as well as with the Regional Inspectorates of the Ministry of Education and Science, with Principles of schools and kindergartens, with non-governmental educational organizations, with local and state administration, with heads of companies and enterprises, with bishops from Bulgarian Orthodox Church.

As it was mentioned above, there are contacts established with employers and there is a system available that allows students to achieve professional realization (courses, internships, career development centers, preliminary contracts etc.).

The University Career Centre is the mediator between employers, academic staff and the students. Its *mission is*:

- to assist young people in their professional orientation and development including those from disadvantaged groups;
- to promote the development of relations and cooperation in the field of vocational training and career development between educational institutions and business organizations, public administration and other representatives from social and economic life;
- to monitor the trends within the labor market and to inform the academic management about labour market requirements. It allows more flexible adaptation between the majors offered and the actual needs of the economy;
- to enhance the professional realization and career development of Bachelor, Master and Doctoral Degree students and graduates;
- to provide information and to consult undergraduate and graduate students in relation to programs funded at national and European level in the fields of education, training and leisure.

The aims, objectives and forms of supporting the career development of students, as well as the possibilities of their realization and internships offers are available on http://careercenters.staj.bg/?uni_id=315. There is a mail-group of students that allows quickly and effective dissemination of opportunities available. The University Career Centre assists students in preparing the required documents and in establishing contacts with the employers.

The University Career Centre organizes meetings and presentations with leading companies and organizations from the public and private sectors. These events aim at presenting to students the opportunities for professional and career development. There are discussions organized between companies' representatives and Shumen University students and bilateral protocols are worked out.

The Career Centre expands its information and consulting activities and deepens its cooperation with employers' organizations, regional employment offices etc.

The interaction process with employers is dynamic through registrations available that allows employers to offer internships, practical trainings and vacancies. The Career Center periodically organizes surveys that analyze employers' attitude towards students' internships and trainings.

Students are duly informed about internships and trainings available for gaining specific skills and competences that are required by the specific needs of the labour market: http://careercenters.staj.bg/?page_id=168. Student can register online on the Web site of the University Career Centre. At the same time, there are lists of contacts of Shumen University graduates that allow getting feedback for their realization (http://careercenters.staj.bg/?page_id=183, 199). There are joint meetings and festive organized with Shumen University graduates. Some of the graduates participate as employers. The graduates' career development is documented in the film „Shumen University – University of Shumen City”

The links with business representatives could be illustrated by the fact that some of them work as part-time lecturers at the University and others participate in University Quality Management Committee and Faculties Quality Management Committees.

The following measures are taken in response to the critical evaluations about the practical training of Shumen University graduates:

- the internships organization is optimized;
- the aims, responsibilities and activities of the participants (students, academic staff, specialists) are updated;
- the quality of performance of internships with their specific stages is increased;
- documentation about organization of different internship programs is available;
- criteria for evaluation of practical trainings and internships of students are updated, as well as those in regard to awarding credits;
- instructions for conducting internships included in the curricula allow students to be introduced to professional environment;
- the specialists are selected and precise financial security within internships is implemented;
- the connections between lecturers, specialists at different departments and specialists are optimized;
- effective indicators for enhancing the practical training and internships are implemented. The aim is to upgrade the system of competencies of students related to their professional qualification and their motivation for realization and career development;
- students' psychological, pedagogical and social training is supported;
- there are established inter-institutional networks with basic institutions and non-governmental organizations.

As a result, the professional skills of students have increased, which had a positive impact on the assessment of the internships, practical trainings and

workshops held. In addition, it is important to say that the positive assessment is due to the practical skills hours included in the curricula (especially in pedagogical and technological majors). The contact hours are about 42,5% of the total workload, which is comparable with European standards.

It can be supposed that the information about the system for evaluation of the knowledge and skills of students available in the curriculum and the student's set, as well as the correct formulation of the assessment criteria implied in examinations form the students' attitude towards the education process and affect their motivation during different seminars and workshops organized.

The results from the surveys in regard to students' opinion about the methods of practical training are periodically analyzed and published. This is the way to get feedback from students and academic staff. The educational content of „Bachelor” and „Master” degree programs are periodically upgraded according to the needs of the practical training and internships. There are initiated negotiations with employers for new internship possibilities. New contracts are signed with employers from state, private and non-governmental organizations.

There is a feedback system developed in *Konstantin Preslavsky University* being a part of the system to ensure the quality of academic activities. That very system includes collecting of information for the realization of graduates in terms of quality of their professional and scientific training, as well as database with various names and contact details of employers and students. There are tools developed (inquiry cards, questionnaires, interviews) that allow to collect information about graduates' realization and their employers' satisfaction.

There is a database for the realization of students after the first, the third and the fifth year of their graduation. That system takes into account 8 indicators - directly employed in a major graduated, not directly employed in the major graduate, employed in another field, researchers, teachers, unemployed, etc.

In order to monitor the realization after the first, the third and the fifth year of graduation The Evaluation and Quality Management Committee at Shumen University together with the University Career Center have developed a system of methods and forms that allows collection, processing and analysis of the data received. The system is developed in accordance with the criteria system implemented in institutional accreditation procedure and set by the National Agency for Evaluation and Accreditation.

The information about the realization of graduates of Shumen University divided into professional fields is presented in Table 2:

Table 2 Students` Realization According to the Data Received by the Main Structural Units and the University Career Centre

Main Structural Unit	Professional Field	Realization in %
Faculty of Education (FE)	1.2. Pedagogy	54,1
	1.3. Pedagogy of Teaching	48,9
	3.4. Social Activities	61,4
Faculty of Natural Sciences (FNS)	4.2. Chemical Sciences	55,1
	4.3. Biological Sciences	20,4
	6.2. Agricultural Sciences and Plant Protection	54,1
	4.1. Physical Sciences	32,5
	3.9. Tourism	62,2
	1.3. Pedagogy of Teaching..	33,7
Faculty of Humanities (FH)	2.1. Philology	64,8
	2.2. History and Archeology	65,4
	2.4. Religion and Theology	79,1
	1.3. Pedagogy of Teaching	63,1
	3.5. Public Communications and Information Sciences	67,9
Faculty of Mathematics and Informatics (FMI)	4.5. Mathematics	88,5
	4.6. Informatics and Computer Sciences	78,7
	3.8. Economics	73,1
	1.3. Pedagogy of Teaching	82,5
Faculty of Technical Sciences (FTS)	5.3. Communication and Computer Technologies	85,5
	5.7. Architecture, Construction and Geodesy	75,3
	5.13. General Engineering	67,1
	9.1. National Security	84,8
College in Dobrich (College)	1.2. Pedagogy	64,7
	4.6. Informatics and Computer Sciences	71,4
	6.2. Agricultural Sciences and Plant Protection	52,4

Surveys within employers analyses their attitude towards staff training, job performance, as well as their attitudes towards preferred forms of cooperation

with the university. Information from these surveys allow improvement of the relationship University - users and support the development of policies for a smooth and successful transition from academic studies to the realization of the labor market.

The employers' opinions and evaluations are largely satisfactory in terms of the training of Shumen university graduates.

550 users were interviewed and were asked to reply to the question: „Do you think that the education at Shumen University has given necessary training and skills for full realization?” The users' answers are as follows: Yes, absolutely - 88,54%; Yes, to some extent - 5,45%; I don't know – 4,72%. The representatives of the University Career Center processed and systematized the survey data.

Another question from the survey is „Why did you hire a Shumen university graduate?” 33,2% of the interviewed replied: „because of the very good training”, 23,22% of them replied they needed „an employee with a higher education diploma in majors offered by the University”, and 11,19% answered „I have already hired Shumen university graduates and was aware of the quality of their training”. 94,58% of the users are satisfied by the fact they have hired a Shumen university graduate, 79,46% are completely satisfied with the knowledge of the graduates, and 65,36% are satisfied with the skills of the Shumen university graduates.

The summary data of 550 employers' answers on the question: „Do the Shumen University graduates possess the following competencies?” is presented in the table below:

Table 3 Types of Competencies Acquired by Shumen University Graduates

Skills / Competencies	Answers in %			
	Yes	Partly	No	Not answered
Fundamental knowledge in the professional area	96,72	1,45	0	1,83
Ability to apply knowledge in practice	89,63	9,27	1,09	0
Information technologies and Computer skills	79,27	17,81	0,90	2,02
Communication skills and ability to work in a team	86,54	10,90	0,18	2,18
Ability to solve problems	88,18	9,45	0,18	2,0
Ethics and loyalty in relations	93,09	4,72	0,18	2,0

Another question: „Which of the competences below should be acquired by young professionals in order to be successful in your organization (company or institution)? The answers are:

Table 4 Business Requirements to Build Different Types of Competences in Students

Skills / Competencies	Ranking in %						
	1	2	3	4	5	6	Not answered
Fundamental knowledge in the professional area	69,27	16,36	7,09	1,81	1,81	2,18	1,45
Ability to apply knowledge in practice	25,09	47,45	24,18	4,0	5,09	2,72	1,45
Information technologies skills	16,54	16,09	25,45	14,72	22,39	12,36	1,63
Communication skills and ability to work in a team	13,81	9,27	27,27	23,45	21,27	13,27	1,63
Ability to solve problems	21,27	13,45	17,81	22,36	29,09	34,54	1,45
Ethics and loyalty in relations	12,36	15,27	16,72	31,63	19,09	33,45	1,45

The answers of the question „Would you like to employ Shumen University students for an internship?“ are as follows:

Table 5 Users` Willingness to employ Shumen University students as trainees

Answers in%					
Yes	Yes, in some cases	Rather No	No	I do not know	Not answered
76,0	15,09	2,0	1,09	3,09	2,73

Another question is: „What recommendations would you like to make in order to enhance the quality of university graduates training“ Expectations are as follows:

Table 6 Users` Recommendations to Enhance Quality of Shumen University Graduates Training

Recommendations	Answers in %
More practical training during the education process	56,36
Work in multicultural environment	10,54
Work with Information technologies	21,36
Students to be more enterprising	9,63
Foreign Language Teaching	24,18
Adaptation of curricula, according to modern educational needs	19,09
Work with bilingual children	2,72

It is 56,4% of the employers from the region that evaluate the level of graduates training with „Very good”. Others (almost 40%) evaluate the training with „Good”. Thus, they recommend their employees to focus on the Master Degree programs offered by the same university.

Employers differ in their opinion about Shumen university graduates` knowledge and skills: 69.3% believe that the graduates` knowledge and skills are „to a large extent” in accordance with the required qualification, 11.3% say graduates` knowledge and skills are „to a very large extent” in accordance with the requirements and 12.6% think, these are „to a lesser extent”. Every second employer believes that the vacancies Shumen University graduates apply for, „basically” are in accordance with the major they graduate.

The opinions regarding the practical training within Shumen University are analogous. 48.9% of the interviewed evaluate the practical training with „good”, 17% of them evaluate the training with „very good”, but nearly one in a four (24 6%) evaluate the training as „satisfactory” and this very fact proves that measures should be undertaken in this direction.

The competitiveness of Shumen University graduates is highly evaluated compared to other universities graduates. It is almost the two-thirds of the interviewed (65%) that define Shumen University graduates competitiveness as „high” and every second asked employer define the skill as „very high”.

Employers` opinion is further examined by organizing annually meetings with them. These meetings discussions include:

- evaluation of the skills of the employees who are Shumen University graduates;

- creating opportunities for students` internships and practical trainings;
- framework contracts for mutual collaboration on students` practical trainings.

Meetings with employers and users are also organized when there is a need to consolidate opinions and to explore their opinions about the labor market status. During the implementation period of the projects BG051PO001-3.3.07-0002 „Students` Practices” and BG051PO001-3.1.07-0040 „Education at Shumen University serves the Knowledge Economy” co-financed by the EU OP „Human Resources Development” the meetings with employers have significantly increased. The meetings are organized individually or in a group. They held every week. The discussions are about the problems in different fields of students` education.

There are regular meetings in September held in the Regional Inspectorate of Education concerning the disciplines included in the professional field *Pedagogy of Teaching*.... The principles of different schools are interviewed during the school-based teaching practices of students.

There shall be continuous contacts (at least twice per a semester) with employers from translation companies, travel agencies, community centers, libraries, museums and other cultural and administrative institutions in connection with summer internship for students from philological majors. Joint cultural and educational initiatives (readings, anniversaries, promotions of publications and so on..) shall be organized. These ensure continuous feedback on the quality of the students' training.

In 2010 the Faculty of Mathematics and Informatics organized a round table where leading experts from the Ministry of Education and Science, mentors and principals from the region participated and discussed issues on:

- the quality of students` professional practical training;
- the professional contacts the academic staff of the *Methods of Teaching Mathematics and Informatics* Department within the Faculty of Mathematics and Informatics have with mentors in schools in order to both to improve the quality of vocational and practical training of students and enhance the training skills of mentors;
- the professional contacts between the University academic staff and teachers from the region in terms of enhancement the professional skills of teachers through the professional qualifications acquirement and organization of qualification courses with different durations.

The Faculty of Technical Sciences within Shumen University regularly organizes meetings with its academic staff and the management bodies of Alcomet Company, 3S COT Company, Alpha 2000 Company and PSIT 35

Company. The aims of the meetings is consulting and research on employers requirements for „System Administrator” and „Automation of Production” job vacancies. The employers` requirements are always reflected in the curricula of the disciplines included in the *Communication and Computer Technologies* professional field.

There are also regular meeting organized between Shumen University representatives and representatives of Regional Inspectorate of Environment and Water – Shumen, Raiffeisen Bank, Trust Fund and etc. The meetings outline the problems that have negative impact on the education process. During these meetings the consolidation on the students` practical training is achieved.

It should be stated that the contacts established between employers, users and Shumen University enhance a favorable environment for professional realization and career development of young specialists.

The opinion of Shumen University students and graduates about the opportunities available for professional realization is reveled by surveys.

The results of the surveys among graduates are listed in the tables below. The surveys held in 2012 – 2013.

The answers of the question „Are you employed directly in the major you have graduated?” are as follows:

Table 7 Shumen University Graduates in % according to the type of employment

Are you employed directly in the major you have graduated?	Answers in %					
	FMI	FNS	FH	FTS	FE	College
Directly employed	33,16	22,69	17,22	22,26	22,43	24,36
Not directly employed	9,51	14,65	18,01	9,24	14,79	26,55
Employed in a sphere not connected with the graduated major	18,50	20,08	13,26	16,38	15,57	21,17
Researchers	1,02	1,80	1,98	0,00	0,29	0,00
Teachers	10,28	7,42	14,85	1,68	25,72	15,29
Not employed	6,16	8,07	5,74	23,10	4,19	4,8
Other/maternity/	3,38	1,40	5,58	5,5	2,22	3,27
Not answered at all	17,99	23,89	23,36	21,84	14,79	4,56
Total	100	100	100	100	100	100

The answers of Shumen University graduates to the question „If you work how long after graduation you have started work?” are as follows:

Table 8 Shumen University Graduates in % according to the time they started their

If you work how long after graduation you have started work?	Answers in %					
	FMI	FNS	FH	FTS	FE	College
Before graduation	10,28	6,22	15,84	9,66	4,35	3,54
Up to the 6 th month of graduation.	44,98	35,94	39,22	20,18	49,72	56,47
Between 6 months and 1 year	8,77	21,88	9,90	0,42	24,66	15,29
From 1 year to 1.5 years	5,65	4,24	0,39	1,26	0,19	0
After the 1.5 years	1,28	0,20	0	0,42	0	0
Not answered at all	29,04	31,52	34,65	68,06	21,08	24,70
Total	100	100	100	100	100	100

Surveys held among the Shumen University graduates after the state exam or during the ceremony of awarding the diplomas give information after the first year of their graduation. Part of the Shumen University graduates continues their education in Master or Doctoral Degree Programs.

The realization of the Shumen University graduates of the 3rd or the 5th year is monitored by the University Career Centre and by Departments and Main structural units within the University.

The permanent monitoring on the realization and development of the graduates and the surveys held on that matter show that, despite of the unfavorable changes in the demographic and economic conditions, the majority of University graduates in the different professional fields are successful and work in state and municipal administrations, business structures. Also, some of them work as a faculty and administrative staff in Shumen University or other universities and scientific institutions. The feedback is positive which comes to prove their high professional qualification.

There is an Alumni.

There is an electronic data base available (Alumni), which has information about 4517 graduate of Shumen University. The information includes the period 2009 – 2013. Moreover, the database is constantly updating and upgrading.

The *Alumni* system provides updated information about:

- opportunities for continuing education;
- organization and conduct of scientific forums, research and sport events;

- opportunities to apply for Master and Doctoral Degree Programs.

The Career Centre prepared an updated data set, which contains basic information about teachers who graduated Shumen University and work in schools. The survey was held in 773 schools in Bulgaria among 4 551 interviewed. The number of those who gave answers is 4 301 and is presented below:

<i>Positions</i>	<i>Number</i>
Academic staff at Higher Institutions	240
Experts	15
Headmasters	218
Deputy Headmasters	61
Head Teachers	62
Senior Teachers	1125
Junior Teachers	35
Teachers	2142
Senior Educators	286
Junior Educators	23
Resource Teachers	33
Speech Therapists	18
Social and Special Pedagogues	13
Pedagogues/Counseling Pedagogical Staff	22
Human Resources Specialists	8
Heads /Computer room, section, unit/	12
TOTAL	4 313

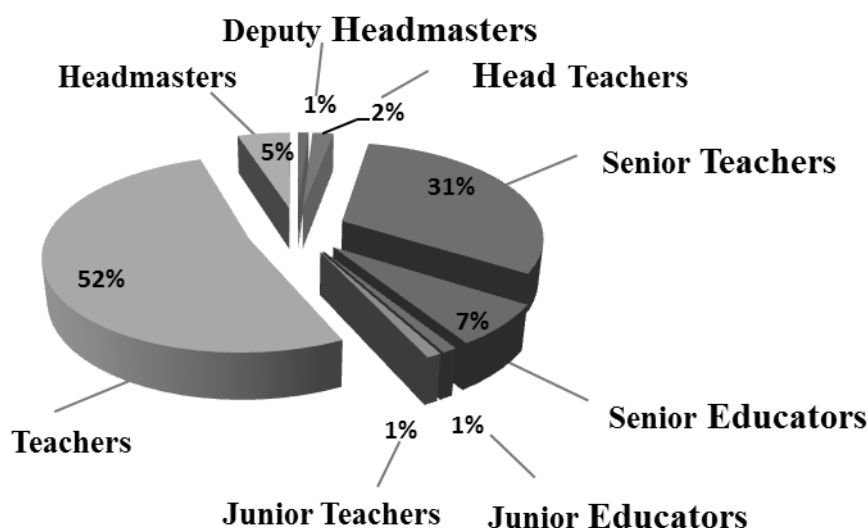


Fig.1. Distribution of positions of the interviewed who work in Secondary School Education System

The conclusions in the analyzed term are as follows:

- There is established and maintained a system of surveys and other forms of feedback for Shumen University graduates. It is a source to make a research on the labor and the intellectual market.
- The different forms of contacts and opinion survey applied, as well as the employers' evaluation about the quality of knowledge, skills and competencies in the professional careers of Shumen University graduates are an important source of information.
- The data allow the University to form its policy about the academic and practical training of students according to the needs of the labor market and the intellectual market.
- The faculties and the departments undertake actions to update the syllabus and to achieve a perfect match between the requirements of the labor market and of the academic staff from the different professional fields that train students at the University.
- It became obvious that Shumen University has provided students with profound training which allow them to get positive feedback by the employers. The training also allows graduates to be flexible and successful in economic and social area.
- The interviewed employers gave high evaluation about the degree of qualification, competence and competitiveness of Shumen University graduates.
- The Career Center at Shumen University offers students the following advantages: contacts between employers and students by participating in the „National Career Days” events; information about paid or free group and individual internships within the European Union; building a professional community by feedback with university graduates employers and professionals in a particular field; organization of events in the form of lectures, discussions, interactive presentations, meetings with professionals, representatives of organizations, companies, agencies and their territorial subdivisions as one of the main tools for promoting business and attracting the attention of the public and business organizations; career counseling for students registered at the University Career Center.
- The Center regularly carries out surveys with graduates, employers and analyzes the results. In addition, the Centre participates in international studies about academic youth opinion within Konstantin Preslavsky University of Shumen.
- *The Commission of evaluation and the quality of education and the academic staff* at Shumen University and committees at the main structural units comprise of representatives of the users of staff, the business and the public sector. Their status is of permanent members.

They actively discuss the status, needs and requirements of the labor market in order to enhance the quality of education, practical training, opportunities for internships in a professional environment and qualification standards for the realization of graduates.

- The inter-institutional, national, regional and international cooperation is expanded, as well as the cooperation with scientific, educational and other organizations and structures to boost research and creative activities.
- The prestige of the University is strengthened by organization of international and national forums in the period discussed; promotion of university scientific and periodicals; training of teachers; signing agreements with foreign universities, etc.
- The process of improving the quality of education in Shumen University, intended to enhance the realization of the students, is a result both of the efforts to apply modern teaching methods and the introduction of educational technologies aimed to improve the inclusion of students in all kinds of activities - research, cognitive and practical activities. The process aims at stimulating students' „original thinking”, analyzing skills to summarize details and expressing their own opinion. Students are encouraged to strive for reduction of information in the learning process and to pay attention on development of skills such as ability to find the necessary information, ability to summarize, discuss and debate, justify their own opinion, as well as to be able to make autonomous decisions in a professional situation, etc.
- Modern teaching methods are applied: methods and techniques to collect information, discussions, games, dialogical lectures with case-studies - analysis of practical situations and etc.

Conclusion

There is a system organized within Shumen University that allows faculties to be informed on due time about the decisions taken by the Rector's Body regarding the enhancement of the quality of training. *By the end of each academic year*, each University unit analyzes the quality of education and identifies the necessary measures for its enhancement. Measures that will allow University to update its activities in accordance with National Agency for Evaluation and Accreditation criteria are identified for longer periods. The effects of these measures are analyzed in self-assessment and accreditation reports made by the Rector's Body.



HISTORICAL DEVELOPMENT OF STRUCTURES FOR THE PROTECTION OF POPULATION

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Abstract: *In recent years, in Bulgaria often arise disasters caused by nature or by human activity. They have a significant adverse effect on the population and the national economy. Therefore reducing the risk of disaster is essential for sustainable development of the country. The likelihood that this trend will deepen is large and there is a need for the establishment of effective governance structures.*

Key words: *reducing the risk, disasters, Geneva Conventions, protection of the population*

Introduction

In the last years of XX and the beginning of XXI century the policy for disaster and accident protection is a top priority for many countries in the world, including Bulgaria. To reduce the risk of them is needed a strong institutional basis, which can be facilitated by capacity building, good governance, promotion of appropriate policies, facilitating the flow of information and the adoption of effective coordination mechanisms. Knowledge of hazards, especially in the increasing volatility and instability of the climate allows for a better understanding of risks, their management, enhancing responsiveness and minimizing the adverse impacts. Information about the economic damage from disasters is also important because it enables the assessment of costs and benefits of various measures to prevent them.

Exposition

Protection of the population, infrastructure and national economy in the event of natural disasters, accidents and catastrophes is a complex activity. It became widespread after the threat of use of nuclear weapons of mass destruction during the Cold War. Since the 70s of XX century began preparations for events to protect the population in case of disasters and catastrophes.

During the period 1936 - 2011, the protection of the population in Bulgaria exists under different names.

On July 18, 1936, was established public service "Civil Protection" with the issued by the Bulgarian King Boris III Decree № 310. The decree approves a Decree-Law of antiaircraft and chemical protection of the population, as well as rules and instructions for its implementation. It defines the obligations of the civil service and armed forces in activities to protect the civilian population, material and cultural values in the Kingdom. In 1942 was formed Governance "Antiaircraft and Anti-chemical Protection", which in 1946 was renamed "Anti-aircraft and Anti-chemical Defense" (PVHO). In 1950 events by organizing anti-aircraft and chemical defense and the preparation of the population for PVHO were assigned to the Ministry of Interior (MOI).

In 1951 a Central Management of Local Anti-aircraft defense was formed, which in 1962 was renamed Civil Defense (GO). The structure was directly subordinate to the Council of Ministers (MS) and in 1971 passed the authority to the Minister of Defense. At the Civil Defense (GO) has been established a system of national defense activities, and in addition entrusted tasks of prevention and mitigation of natural disasters and major industrial accidents. In 1978 at the structures of the Civil Defense (GO) a system of resistance was built to withstand sectors and objects of the national economy and protect the population during military conflicts, natural disasters and accidents.

After the democratic changes in Bulgaria in 1989 started a continuous restructuring and reforming of the Civil Defense (GO). In the process of accession of Bulgaria to the European Union (EU), particularly topical became the issues related to updating the legislation with international standards.

In 1992 from Civil Defense (GO), the organization was renamed Civil Protection (GZ), which reports to the Ministry of Defense (MO). In the same year were created the first five professional staff formations for carrying out rescue and emergency restoration activities in case of disasters, accidents and catastrophes. By 2009, the same formations of Civil Protection (GZ) in the country increased to 31.

In 1994 the Republic of Bulgaria joined the group for cooperation to prevent, protect and organize the major disasters and technological accidents established by resolution (87) 2 of the Committee of Ministers of the Council of Europe. Civil Protection (GZ) formations participate in the work of the Task Force to the Central European Initiative. In 1998 were approved "Rules for organization and procedures for prevention and liquidation of consequences of disasters, accidents and catastrophes."

On March 24, 2000, governance "Civil Protection" at the MoD was renamed "Civil Protection" service and on May 1 it was demilitarized. In 2001, "Civil Protection" service at the MoD was transformed into the State Agency "Civil Protection", subordinated to the Council of Ministers (MS). The Agency

implemented the state policy of protecting the population from disasters, accidents and catastrophes.

State Agency "Civil Protection" initiated the establishment of the civil-military emergency planning for the countries of Southeastern Europe. The agreement was signed on April 3, 2001, in Sofia. In September 2002 was adopted a joint program between State Agency "Civil Protection", Bulgarian Red Cross (BRC), Ministry of Interior - National Service "Fire Safety" and the Ministry of Education and Science, which introduced training to protect the population, for students from 1st to 12th grade.

On November 29, 2002, in Brussels was signed "Memorandum of Understanding between the European Community and the Republic of Bulgaria", which regulated the participation of Bulgaria in the "Community Mechanism to facilitate reinforced cooperation in civil protection." In 2006 the National Assembly passed the Law on Disaster Protection and "Rules" of the Ministry of State Policy for Disasters and Accidents (MSPDA). They regulated the closing from July 1, 2007, of State Agency "Civil Protection", and the formation in its place of the Main Directorate National Service "Civil Protection" (GDNS-ILI) with 28 regional directorates.

By decision of the National Assembly from July 27, 2009, Ministry of Emergency Situations was closed, and on November 11, 2009, were adopted amendments to the Interior Ministry Law. Through them, the Directorate General "Civil Defense" became a national specialized structure of the Ministry of Interior. DG "Civil Protection" was closed on January 1, 2011, according to the latest amendments to the Law on Amending and Supplementing the Law on the Interior Ministry. According to it, DG "Fire Safety and Rescue" was renamed Directorate "Fire Safety and Population Protection" (GDPBZN), and assumed the functions of the closed Directorate "Civil Protection".

Currently the defense is organized and carried out by Directorate "Fire Safety and Population Protection" (GDPBZN), which is a national specialized structure of the Ministry of Interior for Fire Safety and Protection of Population in case of fires, disasters, accidents and catastrophes. The Directorate operates independently or jointly with the executive authorities, legal persons and sole traders, in the execution of their duties under the terms and conditions of the Ministry of Internal Affairs and the Law on Disaster Protection. The main activity of the Directorate is to ensure the protection of life, health and property of the population, as well as environmental protection if any disasters. Protection of the population in Bulgaria when declared a "state of war", "martial law" or "state of emergency", is performed in accordance with the provisions of the Geneva Conventions from 12 August 1949, and the two Additional Protocols from 8 July 1977.

Geneva conventions

Until the signing of the four Geneva Conventions (12 August 1949) and two Additional Protocols (June 8, 1977), it was a long period of devastating destruction and millions of casualties in the two world wars, use of chemical and nuclear weapons, and numerous conflicts caused by social inequality, poverty, ethnic intolerance and aspirations of imposing dictatorship. Thanks to the efforts of the Red Cross, after prolonged international diplomatic conference in Geneva on August 12, 1949, it came to the establishment of universal norms of humanity in armed conflict.

The purpose of the Geneva Conventions is a limitation of human suffering during armed conflict and prevention of barbaric excesses. From 1864 on, those provisions continue to improve. The terms "First Convention", "Second Convention", "Third Convention" and "Fourth Convention" mean respectively:

- Geneva Convention of 12 August, 1949, for the Amelioration of the Condition of the Wounded and Sick in ongoing armed forces conflicts;
- Geneva Convention of 12 August, 1949, for the Amelioration of the Condition of Wounded, Sick and Shipwrecked Members of Armed Forces at Sea;
- Geneva Convention of 12 August, 1949, concerning the treatment of prisoners of war;
- Geneva Convention of 12 August, 1949, on the Protection of Civilian Persons in time of war;

The term "Conventions" means the four Geneva Conventions from 12 August, 1949, to protect victims of war. Those Conventions are a set of rules governing the detailed treatment of the wounded, sick, shipwrecked persons, medical personnel or prisoners of war and civilians and all persons who do not participate or discontinued their participation in hostilities.

The two Additional Protocols, adopted on June 8, 1977, upgrade the protection granted to certain categories of persons and objects, further regulating the means and methods of conducting warfare, both in international and non-international armed conflicts. The basic rules of the Geneva Conventions can be summarized as follows:

- to persons not involved or terminated participation in hostilities, must be granted life and their physical and mental integrity. They must be protected and treated humanely, without any discrimination;
- it is forbidden to kill or wound an enemy who is disabled or has surrendered;
- subjects of protection are : the wounded, sick and shipwrecked persons, as well as medical personnel, medical equipment, vehicles and materials;
- life, dignity, personal rights and beliefs of captured soldiers and citizens must be respected;
- it is forbidden to use weapons or methods of warfare that could cause unnecessary casualties or excessive suffering;

- it is forbidden prisoners of war to be subjected to physical torture, psychological abuse, cruelty or degrading corporal punishment;
- it is forbidden to impose liability on individuals for acts they did not commit;
- for the protection of civilians and property, it is forbidden to become subject to attack the civilian population and individual civilians. Attacks are allowed only against military targets.

Protection of the population according to the protocols of the Geneva Conventions

As already mentioned, the original goal of creating Civil Protection was to protect the population in case of a military conflict. Subsequently, the organization's mission is to carry out activities to protect the population in case of disasters and accidents. According to Protocol I, by the term "civil protection" is understood the implementation of some humanitarian tasks aimed at protecting the civilian population against the dangers of war or disaster, and assistance for the removal of the immediate consequences, as well as creating the necessary conditions for the survival of that population.

According to the same Protocol I, the main humanitarian tasks of protecting the population are: warning; evacuation; providing havens and their fitment; implementation of measures to blackout in danger of air raids; rescue operations; medical services, including first aid and assistance of a religious nature; firefighting; detection and marking of hazardous areas; decontamination and similar protective measures; temporary shelter and supplies; providing emergency assistance in the restoration and maintenance of order in distressed areas; emergency restoration of essential utilities; immediate burial of the deceased; assisting in the preservation of objects essential to the survival of the population; additional actions needed to perform some of the tasks mentioned above that do not only include planning and organization.

Warning (announcement) – expressed in the provision of timely and effective information on approaching or imminent danger of calamity or air danger to a certain circle of people who need to increase their readiness for responding and taking necessary precautions.

Evacuation. Evacuation is carried out by 1873. Used as a preventative measure to protect the population, it has a humane character. Its nature is expressed in the rescue and relocation of the population from dangerous areas to safer ones, in declaration of an emergency or in case of danger of disaster. Most commonly evacuation applies to floods, river overflow, earthquakes, landslides, avalanches, radiological situation and others.

Providing shelters. This task includes design, construction, use, furniture, maintenance, repair of shelters and others. Their construction and maintenance in many countries is imperative as it ensures the safety of the majority of the population in case of different hazards and concerns.

Management of the blackout is a preventive task. It concerns the protection of the population, facilities, military personnel, the means of existence of people and increasing their security of air raids. This task applies only to wartime.

Rescue operations. This task is too complex, diverse, and consists in:

- searching for people in the ruins of buildings damaged by earthquakes, landslides, hurricanes, etc.;
- assistance to people isolated by floods, people found in burned down buildings, buried by avalanches, trapped people in an infected area, etc.;
- assistance to people affected by earthquakes, floods, avalanches, industrial accidents, major catastrophes, etc.;
- are carried out by specialized teams of Directorate "Fire Safety and Population Protection" (GDPBZN) to the Interior Ministry and its territorial units, regional police offices and centers for emergency medical care.

Sanitary and spiritual service. The health service is to provide medical assistance to the injured and affected people from war, flood, earthquake, industrial accidents, catastrophes and others. Performed by medical staff and the Bulgarian Red Cross.

Religious assistance is provided to wounded and dying by clergymen - priests, imams and others.

Firefighting. Performed by specialized services, it aims to rescue people and protect facilities of national economy and population.

Detection and warning for hazardous areas. These activities are required to detect, indicate and mark dangerous areas such as minefields, contaminated areas, volcanic zones, destabilized buildings after an earthquake, zones of radiation, landslides, avalanche areas and others.

Decontamination. The activity includes:

- decontamination of water and water sources (i.e. their cleansing);
- decontamination of persons, housing sites and facilities. Their combustion is allowed in order to not spread diseases and epidemics;
- infected persons are quarantined, and infected areas are under medical supervision.

Providing shelter and food. For survival of the victims are constructed tents, shacks of prefabricated elements, vans and water tanks are provided, clothing, blankets, medicines and others. Mobile kitchens and canteens are formed, food warehouses, water sources are recovered and purified, care is taken for food supplies for the population, and others.

Maintenance of order in the disaster area. This task is usually performed by the bodies of the Interior Ministry. Their task is to fight the crowd at intersections, exit roads, tunnels, underpasses, overpasses, bus stations, railway stations, not to create chaos, disorganization, disorder and the emergence of panic. They should intersect attempts to looting and theft, carried out by unscrupulous and criminal individuals.

Restoring communications. The task objectives are rapid recovery of aqueducts, power lines, gas pipelines, to prevent contamination of certain areas and the occurrence of epidemics.

Burials. They have humanitarian, hygiene, ethnic, religious and routine function.

Protection of sites and resources needed for the survival of the population. The problem is related to the protection and preservation of food warehouses and shops, agricultural sites and areas, animals, plants, irrigation systems, water supplies and other, necessary to feed the lives of civilians. Their protection can be carried out by gunmen.

The last task completes all missed in the following fourteen, and is aimed at liquidation of the consequences of the disaster and survival of the population. This task includes activities related to planning, financing, management of vehicles in the disaster area and others.

Conclusion

Under the provisions of the Law on Disaster Protection and other regulations, one of the main tasks of the state is the development and the formation of national policy to protect the population and national economy, as well as regulation of social relations if any disasters and accidents occur. The law provides protection of life, health and property of the population and environmental protection in case of emergencies. At present, protection of the population is carried out by the General Directorate "Fire Safety and Population Protection" of the Ministry of Interior (GDPBZN-Interior Ministry) and components of the URS. The protection is carried out at national, regional and municipal level by conducting preventive action, preparedness to respond to disasters and emergencies, assistance and recovery, resource provision, delivery and acceptance of the aid.

References

- [1]. Sandev G. Lectures on Civil Protection. Shumen, 2014, 105p.
- [2]. Slatinski, N. Four lectures: Introduction to risk management, 150p.
- [3]. Geneva Convention (first, second, third, fourth and the protocols thereto). MoI 2014, 58p.
- [4]. Law on Disaster Protection, amend. , SG. , issue 81 / October 20, 2015, 37p.
- [5]. The Ministry of Interior Act, amended SG. , issue 61 / August 11, 2015, 36p.
- [6]. Decree № 8121z-196 for the procedure of carrying out preventive control by the authorities of GDPBZN to the Ministry of Interior, amended SG. , issue 17 / March 6, 2015, 13p.
- [7]. Decree № 8121z-758 to carry out preventive action by the authorities of Fire Safety and Protection of Population to Interior Ministry, amended SG. , issue 90/30, October 2014, 16p.

- [8]. Decree № 8121z-1006 on the procedures for carrying out firefighting and rescue activities by the authorities of Fire Safety and Protection of Population to the Ministry of Interior, amended SG. , issue 67 / September 1, 2015, 46p.
- [9]. Ordinance terms and conditions for conducting evacuation and deconcentration, amended SG. , issue 103 / December 28, 2012, 8p.
- [10]. National Plan for Disaster Protection, Council of Ministers, Sofia, 2010, 412p.
- [11]. National Defense Strategy. Sofia, 2010, 30p.
- [12]. National Program for Disaster Protection 2009 - 2013. Council of Ministers, Sofia, 2009, 55p.
- [13]. National Program for Disaster Protection 2014 - 2018. Council of Ministers, Sofia, 2013, 73p.



ИЗИСКВАНИЯ КЪМ АВТОРИТЕ

В списание “Scientific and applied research” се публикуват на английски език кратки научни съобщения, отразяващи нови, непубликувани резултати от проучвания в областта на математическите, физическите, химическите, биологическите и медицинските науки, науките за Земята, инженерните, педагогическите и аграрните науки. Текстовете на статиите трябва да са подготвени за печат. Не се предвижда допълнително редактиране. Статиите се изпращат на адрес:

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Полетата на всяка страница трябва да са: ляво 25 mm, дясно 25 mm, горно 25 mm, долно 30 mm. На листа не се чертае рамка. На първа страница над заглавието да се оставят 60 mm (т.е. горно 25 + 35mm), на формат A4. Максималният обем на статиите е 8 страници. Студия се оформя както статия, в обем от 21 до 30 страници.

УКАЗАНИЯ ЗА ОФОРМЯНЕ НА ТЕКСТА

ЗАГЛАВИЕ – Font: Times New Roman; Size: 14; Fontstyle: **Bold**; Effects: AllCaps; ParagraphAlignment: Centered.

ИМЕНА НА АВТОРИТЕ се печатат през 1 празен ред под заглавието в разгърнат вид - пълно собствено и пълно фамилно име; Font: Times New Roman, Size: 14, Fontstyle: **Bold**, ParagraphAlignment: Left, по средата на реда – Centered.

АНОТАЦИЯТА И КЛЮЧОВИТЕ ДУМИ НА АНГЛИЙСКИ ЕЗИК се оформят така: Анотацията (**Abstract:**) в обем до 10 реда - Font: Times New Roman, Size: 12, Fontstyle: *Italic*, ParagraphAlignment: Justified; през 1 празен ред следват ключовите думи (дескриптори - **Keywords**) – Font: Times New Roman, Size: 12, Fontstyle: *Italic*; ParagraphAlignment: Justified, и двата елемента с отстъп 1 cm вляво от рамката, ограничаваща основния текст.

ОСНОВЕН ТЕКСТ – Font: Times New Roman, Size: 14; ParagraphFirstline: cm, Linespacing: Single, Alignment: Justified. Фигурите, с обяснителен текст, трябва да бъдат прецизно изработени и равномерно разположени върху страниците. Задължително е използването на международната система за мерните единици (SI). Чертежите, илюстрациите и снимките се обозначават в текста като фигури, съкратено „фиг.“. Те трябва да бъдат ясни и контрастни и да се придружават от текст. Приложените фигури и снимки да не са цветни.

Литературата в текста се означават с цифра, заградена в квадратни скоби [1]. Номерацията на формулите се означават вляво от тях в малки кръгли скоби (). Литературата, посочена в края на доклада, се изписва съгласно стандарта за библиографско описание, на английски език а цитиранията в текста се означават с цифра, заградена в квадратни скоби [1].

Литературната справка трябва да съдържа не повече от 20 публикувани работи, цитирани в статията, подредени в хронологичен ред според цитирането им в текста. Името на първия автор се дава в инверсия. Следват съкратеното заглавие на списанието, том, година, книжка, страници (от - до), а при книги и монографии - заглавие, град, издателство, години, страници.

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Original Contribution

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