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GEOINFORMATION MODELING OF THE RIVER SYSTEM GOLIAMA KAMCHIA

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ABSTRACT: *To be modeled a river system in modern conditions it is necessary to carry out hydrological and hydraulic modelling, geoinformatic modelling. In recent years it is essential the implementation of geoinformatic modelling. It achieves a real opportunity for representation, evaluation and prediction of phenomena occurring in the river system.*

KEY WORDS: *DTM, TIN, GRID, GPS, TOPCON, ESRI, GIS*

General

One river system to be modeled in modern conditions, it is necessary hydrological, hydraulic and geo-information modeling to be carried out. The application of geo-informational modeling is essential in the recent years. Through it real possibility for visualization, evaluation and prediction of phenomena occurring in the river system is achieved.

1. Topographical and geographic data

Topographic and geographic data are used in:

The modeling scale of 1: 5000 or larger is used, and data precision of the vertical measurement of m_h=±10 cm. The number of LTM (large-scale topographic maps) in scale 1: 5000 is 84 for the area of Shumen and Varna; they cover most of the required area.

Also other raster maps in scale 1: 25000, 1: 50000 and 1: 100000 covering the study area are included,.

DTM (digital terrain model) with a resolution of 70 m is also selected and included in the GIS database. Its use is limited to the analysis of the riverbed for hydrological modeling. In addition, orthorectificational satellite and aero - photo images are used.

Other cartographic information is provided by geographical data of the Basin Directorate in Shumen and Varna.

They include the system of river sections and the division of the sub-basins of water throughout the watershed. This database is created with varying quality to a scale of 1:50 000 to 1: 200 000.

All hydro meteorological stations are included in this database as accurate data. Each hydrological station also has a profile of cross-sections. The vertical section of the water systems are partially validated or corrected during surveying.

Most of topographic maps are from the 60s - 80s of the last century. Therefore, there are many changes that are seen in modern satellite images with high resolution (mainly from the American satellite SPOT and French – Quickbird; they are obtained from the Center for Remote Sensing Application - RESAC-Bulgaria). Then these images and the available for the region orthophotos served for updating of the river courses, which corrected version was included in the geodatabase.

In comparing satellite images of the route of the river and the database were spotted some discrepancies with the reality. These differences are due to the digitization of the old maps in small scale. It was necessary to fix the digital riverbed and the selected tributaries in the geographic database to obtain consistency between the topographic data and the captured data of the riverbed hydraulic model.

For the geo-information modeling are accepted as true the data of the secondary river network. For modeling purposes, topographic contour maps are digitized to create a digital terrain model TIN (GRID) - DTM, which is subsequently used for flood mapping.

2. Topography-geodesic studies

At the initial stage, 50 cross sections ape carefully selected to be tested for the construction of geoinformation model. It is noted that 200 cross sections should have been explored (average in 500 m).

When selecting cross sections restrictions have been introduced imposed by the geo-information modeling. The profiles are intended to be made on all obstacles on the river (dams, bends or narrow bridges). The number of cross sections is increased on those parts of the river current, which are located immediately before and after different (flood-prone) cities and towns. The number of the profiles in the cities is less because the water flows in urban areas are more stable. A detailed methodological description is made on the surveying and the quality control, exerted on the working group that performed the survey.

The determination of each one of the profiles which had to be tested was precisely defined with the help of maps, orthophotoplans or satellite images that assisted in the detection of changes in river beds, as well as the description of the new man-made structures (Fig. 1). Separate database for each profile was created from the gathered information. Using topographic maps these separate databases determine the exact position and extensions to the profile in capturing.

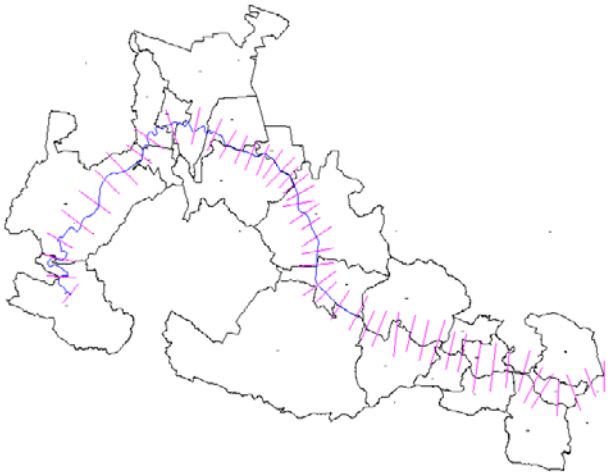

Fig. 1

The team performing the surveys consisted of six surveyors from geodesic company with experience in engineering geodesy. The team was equipped is with modern GPS receivers and total stations of laser TOPCON. The group is composed in the middle of March 2012

Fig. 2

Downstream after Dalgopol towards the Black Sea are selected profiles through which the model covered the river to the mouth of the river Kamchia. These profiles are combined with topographic information to "follow" the route of flooding to the Black Sea.

Cross sections are designed on some tributaries. The profiles are measured at the confluence place of the flow with the river.

Surveying were made in the period of March – May. After the quality control of the measurement data, correcting or re-measurement of certain profiles is carried out.

3. Modeling of the river system of river Kamchia

3.1. General review of the modeling

A river system can be modeled using the following approaches: [6]

- hydrological modeling;
- hydraulic modeling;
- Geoinformation modeling. [1,2]

Hydrological modeling is applied in river basins, in which the rainfall is required to be converted into water runoff in river points.

Hydrological processes are quite complex as rain or snow does not go directly into the riverbed and follow conceptually different route, passing through various transformations until they reach the basin outlet.

There are different ways of modeling these processes of transfer of water from rain to runoff in rivers: hydrological models can be generalized (a basin is considered as a whole) or distributed (the basin is broken into small segments (1ha), in which modeling of processes and combining with others is performed.

Generalized models are usually used in hydrology. Such is the approach in this experiment.

Hydrological modeling allows tracking the movement of high wave along the river flow by identifying the elevation of the water surface. Individual elements may be 1D (one-dimensional) or 2D (two-dimensional plane).

The following table shows the watershed of the river. Kamchia. The river is modeled in two parts: from Ticha dam to the village of Cherni Vrah (District of Shumen) and from the village of Cherni Vrah to the Black Sea (District of Varna). After the completion of the modeling of every part, both models are combined and validated as one model. The length is measured in kilometers.

First part of the river Goliama Kamchia

Table 1

Name of the hydrodynamical model	CRS	Length
Kamchia	50	40 km
Vrana	1	68 km
Poroina	1	19 km
Brestova	1	15 km
Sum	53	142 km

Second part of the river Goliama Kamchia

Name of the hydrodynamical model	CRS	Lenght
Kamchia	50	63 km
Luda Kamchia	1	5 km
Eleshnitsa	1	5 km
Sum	51	73 km

B) Creating a hydraulic model

Hydraulic models are created using the exact details of the river beds, the ratio of the total runoff, storage mechanisms on floodplains, and significant structures such as bridges, dams, dikes, terraces, drained swamps. Detailed topography of the threatened from flood regions to the intersection of the slope, to the terraces or hills is required to form and shape the hydraulic system.

The hydraulic modeling is based on points, which are connected in a topological network. The related items in the main channel and the nearest left and right side of the floodplain terrace.

The items in the floodplain associated with topographic structures such as dams, roads, railways, whose borders of the retention zones are defined, but in addition, flooding can be modeled by equations using overflowing water quantities.

Since the detailed topographic description of the water level is the main variable, controlling the modeling of currents in the spill, the topographic information must be sufficiently precise to enable the model to be effective in its forecasts. Accuracy ± 10 cm in the values of the topographic structure is generally desirable for these models.

Depending on the topographic variations of the riverbed and fortifications, the distance between the transverse profiles can be from 2-3 kilometers to 500 meters.

When the flood territory and the slope of the riverbed are in plains, as it is the case with the lower reaches of the River Kamchia, the hydraulic models are very sensitive to inaccuracies in topography. This means that variations in water level (which may be the result of not good topographic survey) between real and simulated data will propagate down and upstream, which will generally lead to a bad result.

The main drawback of the hydraulic models, is the quality of geoinformation used for constructing topology.

The development of the hydraulic model comprises the following steps:

- Collection and processing of cross-sectional and topographic data.
- Assessment of the terrain in which the water flows and the terrain on which the water retains in the cross sections and in the spills.
- Collection and processing of measurements of the level and quantity of water flow of the hydrological stations and stations located on tributaries of rivers from first order.
- Collection of data on hydraulic structures and ways of managing them.

Construction of the model by introducing:

- The boundaries of the river and its tributaries with practical significance;
- The cross sections;
- The lateral and boundary flow;

The calibration and validation of the hydraulic model by testing it with historical data leads to minimization of deviations from the model of the stations reported levels and amounts of water.

It should be borne in mind that the calibration and validation of the model can only begin when all necessary information is collected, analyzed and processed, the steps before the model check do not depend on each other and can be implemented separately.

C. Establishing geoinformational model

As it is seen from the hydrological and hydraulic models, a central place in their construction is occupied by the reliability of geo-information model.

Geoinformational model created by the method of digitizing of topographic maps

For the preparation of geoinformational model by the method of digitization of information from topographic maps are collected and analyzed the following materials:

- Topographic maps in scale 1: 25000;
- Large-scale topographic maps (LTM) in scale 1: 5000;
- Cadastral maps in digital form;
- Coordinate lists, registers and catalogs of geodetic points SGN DGPSM, GMMP, BER and others. [5]

LTM in scale 1: 5000 are scanned from the nomenclature order covering the territory of the river Kamchia (84) and topographic maps in scale 1: 25000 (25). Scanned images are in raster format with the extension JPEG. In an environment MKAD the raster images have been georeferenced in coordinate system in the 1970 K-7. A series of related LTM throughout the valley of the river are produced. Transformation of the image of the coordinate system 1970 K-7 in the coordinate system UTM - WGS 84 -area 35N is performed in an environment MKAD

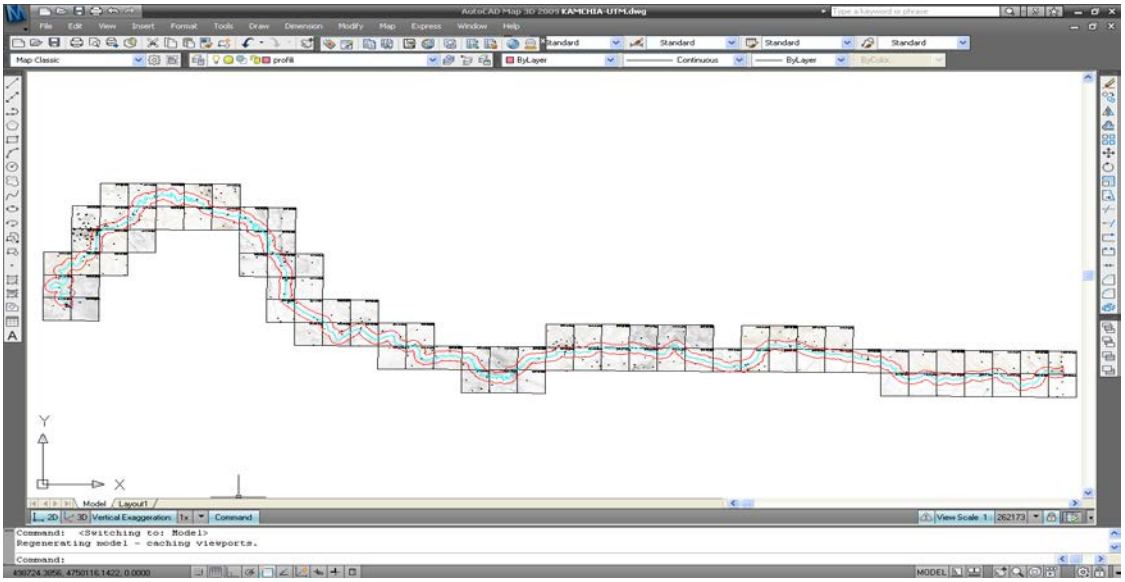

Fig. 3

On the basis of the resulting image, vectorisation is performed. First it is created a layer "relief" and basic, additional and auxiliary contours with main section of the relief 5 meters (1 m) are vectorized. The vectorisation is performed in an environment AutoCAD map. The data for metrics and semantics are saved in files with extension DXF and DWG, files for environment ESRI - extension SHP are created. Objects (the horizontals) in the layer "relief" are obtained using a discrete graphics primitive POLYLINE. The data for the objects are stored in the object-oriented relational table of the layer (theme). The correctness of the data in the table is check and if necessary, corrections are made. In an environment ESRI - ArcGIS (ArcView) the theme "relief“ is added on. The coordinate lists of the points of SGN, GMMP, DGPSM, BER a TXT or DBF format tables, which enrich the information about the r landscape are additionally introduced. The resulting theme is of points. For the obtaining of a surface model of the researched area, based on the information from the linear and point themes "relief" an irregular network of triangles is created (TIN). On the basis of the created TIN model is created GRID model and raster DTM model. [3]

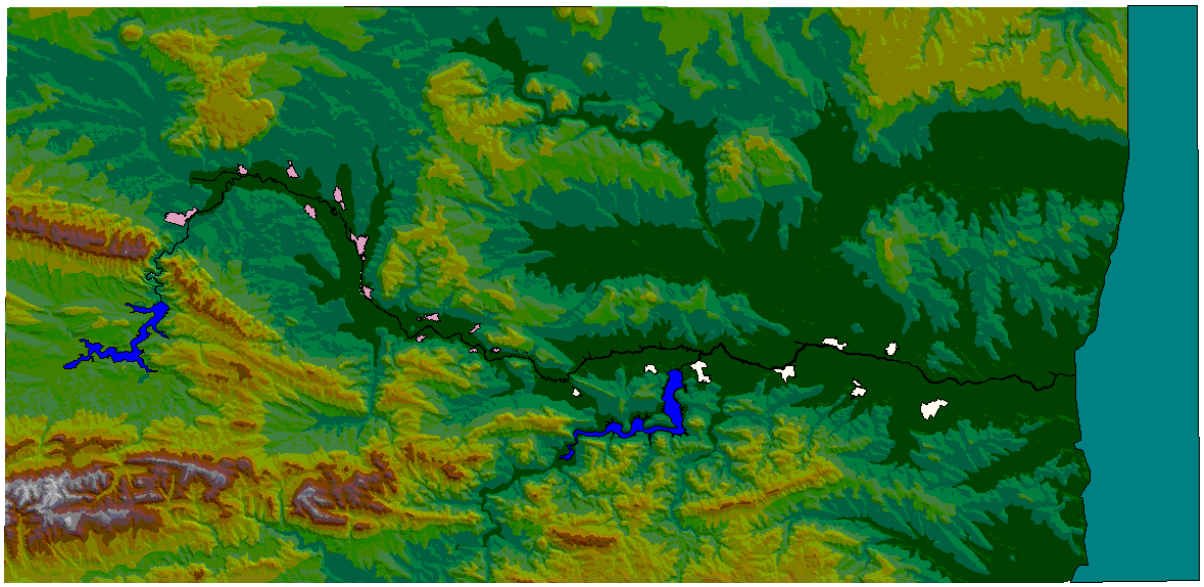

Fig.4

After the topic "relief", theme "hydrography" is created. River Goliama Kamchia is vectorized, as well as a part of the major tributaries – river Vrana and river Luda Kamchia, dam Ticha, dam Tsonevo and part of the Black Sea. The vectorisation is done in an environment AutoCAD map. The data for the metrics and semantics are saved in files with extension DXF and DWG, files for environment ESRI - extension SHP are also created. Objects (rivers, lakes, sea) in layer "hydrography" are discreetly created using a graphic primitive POLYLINE. Polyline then is edited and presented as a polygon. The exportation

of the layer "hydrography" from AutoCAD map in ESRI - ArcGIS (ArcView) is performed as a polygon theme with SHP file. [7, 8]

Topics "roads", "vegetation" and "settlements" are created successively. In the theme “settlements” information from the cadastral maps in CAD format and ZEM is used. All files are previously transformed into a coordinate system UTM - WGS84 - Zone 35N.

Refernces

[1]. Andreev, A.I, Modern geoinformational concept and technologies for modeling of security. Dissertation, UNIBIT Sofia, 2012.

[2]. Andreev, ., Markov M. Geographic Informational Systems. NMU "C. Levski ", Shumen, 2009.

[3]. Andreev, A.I, Markov M. Manual exercise in Geographic Informational Systems. NMU "V. Levski ", Shumen, 2009.

[4]. Andreev A. Angelov A., M. Markov Models for representation of the Earth's surface, and TIN GRID and their applications. Military University "Vasil Levski" NS'2002, Shumen, Collection of scientific works part III, (pp. 223-231), 2002.

[5]. Boyko, A. V. Methods and tools for automation of topographic images. M., Nedra, 1980.

[6]. Methods for the preliminary assessment of flood risk according to Directive 60/2007 / EU-MEW, C, 2011

[7]. Berry, Joseph K. Beyond Mapping: Concepts, algorithms, and issues in GIS. GIS World Books, 1993.

[8]. GIS for Everyone. ISBN 1-879102-49-8. ESRI Press. 380 New York Street, Redlands, California 92373-810. WWW.esri.com/gisstor.

[9]. MIKE 11 GIS - Floodplain mapping and analysis - DHI Water & Environment DK 2001

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PARTICULATE MATTER AIR POLLUTION (PM_{10} and $PM_{2.5}$) IN URBAN AND INDUSTRIAL AREAS

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ABSTRACT: *An assessment is made of atmospheric air pollution from particulate matter (PM_{10} and $PM_{2.5}$) for the period 2007-2014 in two regions: urbanized and industrial, at three monitoring stations: city background, transport-oriented, and industrial-oriented. The annual, seasonal and diurnal variations of the PM_{10} and $PM_{2.5}$ concentrations in the atmospheric air of both regions have been reviewed. The monitoring results have been statistically processed using the variation analysis method and the differences have been estimated with A. Fisher-Student's t-distribution test.The results show that PM_{10} concentrations are the highest at the transport-oriented station and during the whole monitoring period, they vary between 49.31 and 53.12µg/m$^{3.}$ and exceed the average annual human health safety norm (40 µg/m)^3. There is an explicit seasonal correlation in atmospheric air pollution depending on atmospheric air pollution from particulate matter: higher levels during the winter months as compared to the summer months of the year. Measures have been proposed for decreasing the emissions of PM_{10} and $PM_{2.5}$.*

KEY WORDS: *PM_{10} , $PM_{2.5}$, atmospheric air, seasonal correlation, diurnal variations*

INTRODUCTION

Particulate matter is the basic and most common atmospheric air pollutant. It consists of dust particles, small water droplets and other chemical substances additionally adsorbed onto their surface (organic compounds, metals, allergens in the form of fragments from pollen, moulds or/and spores). Particulate matter (PM) is emitted directly during a number of naturally occurring processes, as well as from different anthropogenic activities or are formed secondarily as a product of chemical transformations in the atmosphere [12]. The larger particles measuring above 10µm reach only the upper respiratory tract and provoke mainly irritation to the eyes, nose and throat. The particles measuring between

2.5 and 10μm ($PM_{2.5}$ and PM_{10}) reach the lungs. The smallest ones, measuring below 2.5μm, reach the alveoli from where they pass into the bloodstream and through it to all organs and systems of the human organism.

The basic sources of the total anthropogenic emission (6) of primary PM_{10} (with aerodynamic diameter between 2.5 and 10 μm) are:

- Automobile transport: 10 – 25%;
- Fuel combustion in stationary installations (solid and liquid fuels – coal and petrol): 40 – 55%;
- Technological processes in industry: 15 – 30% (mainly released from cement production, coal mining, ore mining);
- Transfer from distant sources.

The contribution from automobile transport to the level of ground PM_{10} concentrations in cities and the exposure of the population to it is rather greater than the contribution of automobile transport to emissions. In the centres of some European cities, 24% of the atmospheric air pollution comes from internal auto transport, and as a result of a distant transfer of PM_{10}, coming again from auto transport, additional 17% particulate matter pollution is formed. [16].

The PM_{10} concentrations under 100 $\mu g/m^3$, given as a daily average concentration, influence the death rate, as well as the number of hospitalization because of respiratory diseases, heart disease, etc., relating to the health of the population. For that reason the World Health Organisation does not recommend short-term norms for PM_{10} for the countries in Europe. [1].

Long-term exposure to low PM_{10} concentrations leads to shorter lifespan. It also leads to increased number of bronchitis diseases among children and reduced lung function in children and the elderly. [13, 16]. These effects are observed at concentrations of 20 $\mu g/m^3$ for $PM_{2.5}$ and for PM_{10} – 30 $\mu g/m^3$.

Many authors' research shows that the consequences for the health of the exposed population include respiratory and heart diseases – asthmas get worse, people suffer more from chronic bronchitis, the number of hospitalizations rises. [4, 12, 15]. Also there is a rise in the death rate from heart and respiratory disease, as well as from lung diseases. [13, 21].

The information which is the basis for the studies on the impact on the population's health includes average daily concentrations of PM_{10} and $PM_{2.5}$. The hazard of the appearance of numerous impacts for the health rises linearly with the rising of fine particulate matter daily values. For that reason, the monitoring system must guarantee a full set of day and night data, on the basis of which an analysis can be made of the daily fluctuations of particulate matter concentrations and their impact on people's health.

The aim of this survey is to assess atmospheric air pollution from PM_{10} and $PM_{2.5}$ in an urbanized and industrial region and trace the annual and monthly particulate matter content, the seasonal dependencies, as well as the keeping of the human health safety norms.

MATERIAL AND METHODS

The monitoring of the atmospheric air content as relating to atmospheric air pollution with particulate matter ($PM_{2.5}$ and PM_{10}) encompasses the 2007-2014 period in two regions: an urbanized region (the city of Varna) and an industrial region (the town of Devnya). Varna is the third biggest city in Bulgaria, with population of over 350 000 citizens and is also the biggest city in Northeast Bulgaria. It has been announced a functional urban region (FUA), in the European cities classification. As the main centre for the Northeast planning region, Varna is characterized by well developed economy, with specific sectors being marine industries (shipbuilding, ship repair, maritime transport) and the tourist industry.

Devnya industrial region is located in the northeast part of Bulgaria, 30 km from the main county city of Varna. On the territory of the region, the following enterprises are located: *Solvey Sodi AD* calcined soda plant, *Agropolihim AD* Nitrogen and Phosphate Fertilizer Integrated Works, *Devnya Cement* Cement and Clinker Works, *Devnya* Electrical Power Station, *Martsiana* Quarry, *Varna-Zapad /Varna-West/* Port, and a phosphogypsum depot.

The atmospheric air pollution at the stations, part of the National Control System for Atmospheric Air Quality Control with the Executive Environment Agency, Bulgaria has been monitored as well. Two stations are located in the urbanized region of Varna: an urban background station and a transport-oriented station. The urban background station is located at: +043.13.27.80; +027.54.56.64. and functions as an automatic measuring station with a 24 hour work schedule and has been classified as an urban background station with a range between 100 m and 2 km. The transport-oriented station is located in the central area of the city at coordinates: +043.13.00.00; +027.54.41.00. By Order of the Minister of Environment and Water, it has been classified as: transport-oriented station with a range between 10 and 15 m; and an urban background station with a range between 100 m and 2 km. The station has been functioning as an automated measuring station as of 2009, with Eoi code: BG0042A with the National System for Ecological Monitoring (NSEM).

In the Devnya industrial region, the NSEM has been functioning as an automated measuring station as of 1990, with Eoi code: BG0013A-Dv1 and geographical coordinates: +043.13.12.00; +027.33.40.00; and 24-hour work schedule, registering real time data. The station is classified as industrial-oriented with a range between 10 and 100 m and as an urban background station with a range between 100 m and 2 km.

The data from the automated measuring stations in both regions is fed real time to the regional dispatcher station (regional database at the Regional Environment and Water Inspectorate) and at the central dispatcher station of the Executive Environment Agency, Sofia – the national database for atmospheric air quality.

The annual, seasonal and diurnal variations in the PM_{10} and $PM_{2.5}$ concentrations in the atmospheric air in both regions have been monitored. The monitoring results have been statistically processed with the variation analysis method and the differences have been evaluated with A. Fisher-Student's t-distribution test.

RESULTS AND DISCUSSION

Monitoring results show that PM_{10} concentrations in the urban background station in Varna have been the highest since the start of the survey – 39.98 μg/m^3 (2007) and are at the limit of the average annual human health safety norm (40 μg/m^3). Over the following years, PM_{10} concentrations vary between 33.43 and 38.72 μg/m^3, with the lowest PM_{10} levels in 2008 – 22.96 μg/m^3 and in 2012 – 23.56 μg/m^3, and the differences have high statistical significance ($0.002 \leq P \leq 0.05$) (Fig.1). After 2012, again higher PM_{10} levels are observed, and at the end of the period (2014) the concentrations reach up to 34.50 μg/m^3, and these differences, again have high statistical significance ($0.025 \leq P \leq 0.05$).

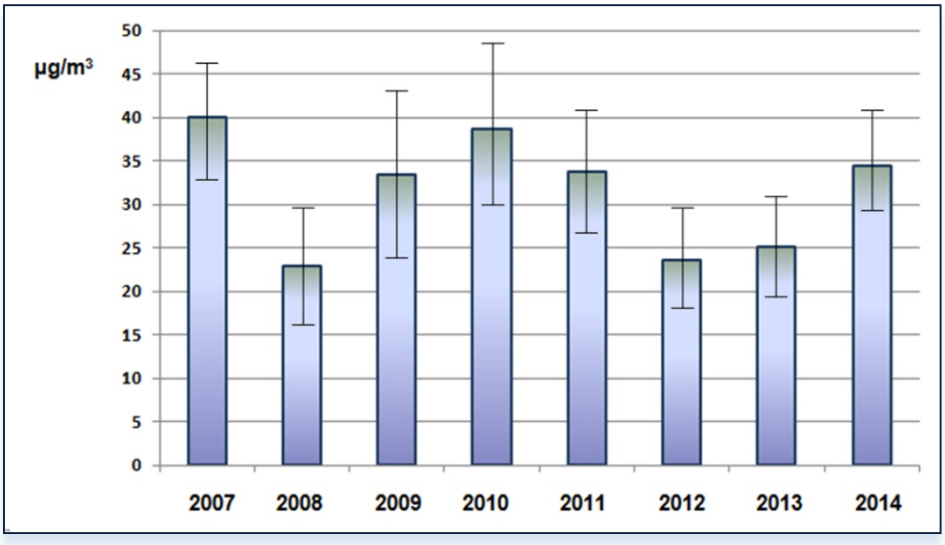

Fig.1. Average annual PM_{10} concentrations at the urban background station

In the traffic-oriented station in Varna PM_{10} concentrations are quite higher. Between 2007 and 2014 the average annual concentrations vary between 49.31 and 53.12 μg/m^3 and exceed the annual human health safety norm from 1.07 to 1.33 times (Fig.2).

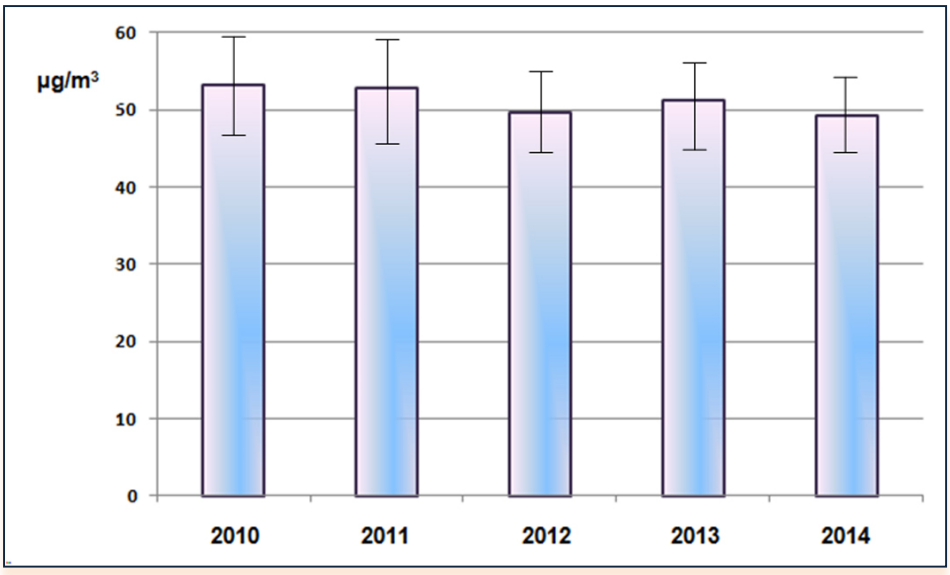

Fig.2. Average annual PM_{10} concentrations at the traffic-oriented station

No significant variations have been observed over the years ($P > 0.05$), with PM_{10} atmospheric air pollution in the central city parts being above norm and unchanging during the whole monitoring period.

At the industrial station in Devnya, PM_{10} concentrations are the highest at the beginning of the survey (2007-2008) – 31.21 - 32.72 µg/m^3 and do not exceed the average annual human health safety norm (40 µg/m^3). After 2008 the average annual concentrations are rather lower – 22.95 µg/m^3 (2009), 23.11 µg/m^3 (2010), 23.63 µg/m^3 (2012), and the differences have high statistical significance ($P < 0.05$) (Fig.3). After 2012 there has been gradual increase of PM_{10} concentrations – going up to 30.54 µg/m^3 in 2014, and the differences are statistically credible ($P < 0.025$).

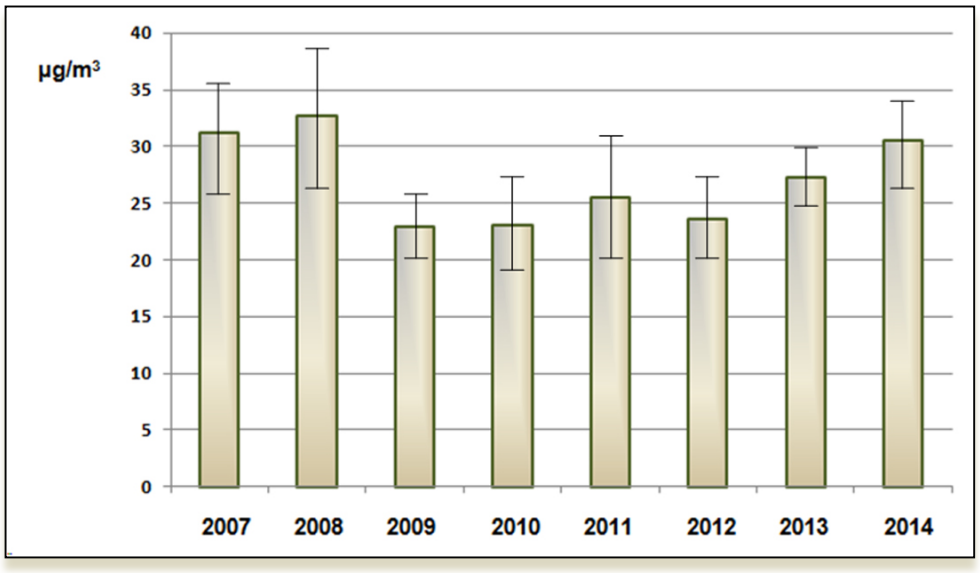

Fig.3. Average annual PM_{10} concentrations at the industrial-oriented station

$PM_{2.5}$ monitoring has been carried out mainly in the urban background station in Varna, as it is the only permanent station in Northeast Bulgaria with a particulate matter analyzer for that size. The results reveal that $PM_{2.5}$ concentrations are the highest at the beginning of the survey: 2009 – 20.39 µg/m^{30}, and the average annual human health norm (25 µg/m^3) has not been exceeded. After 2009, the $PM_{2.5}$ levels are rather lower and in 2013 they go up to 7.85 µg/m^3, and the differences have high statistical significance ($P < 0.001$) (Fig.4).

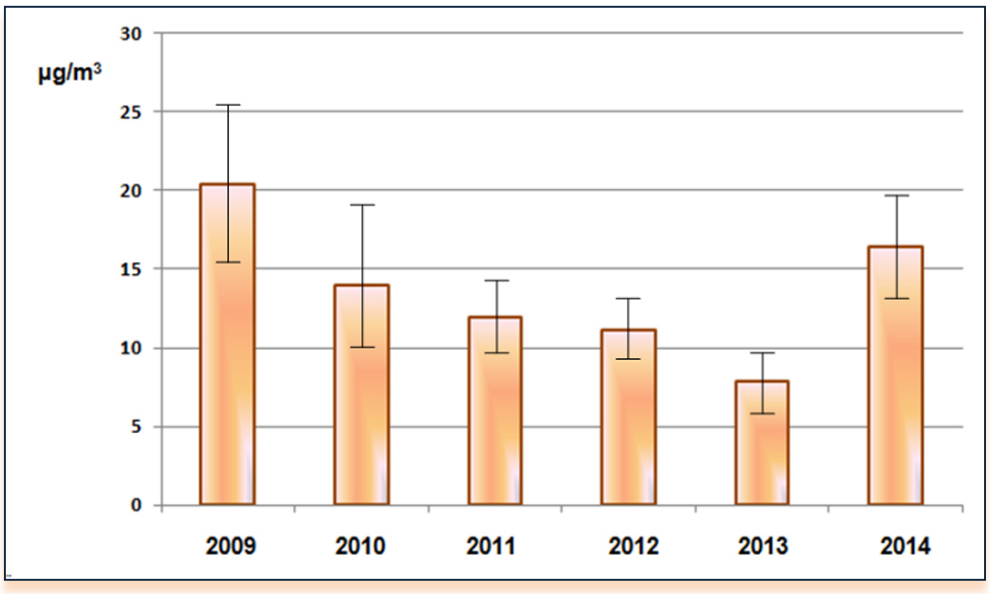

Fig.4. Average annual $PM_{2.5}$ concentrations at the urban background station

After 2013, a sharp rise is observed in $PM_{2.5}$ pollution – 16.39 µg/m^3 in 2014, and the differences again have high statistical significance ($P < 0.001$).

The monthly and the seasonal variations in atmospheric air pollution with particulate matter in both regions show that PM_{10} concentrations at the urban background station are higher during the cold season of the year as compared to the warm season. In 2013 the average monthly PM_{10} concentrations in the winter months reach up to 49.49 µg/m^3, and exceed the average annual norm (AAN) for human heath safety (40 µg/m^3) 1.24 times, and during the summer months the levels range between 12.70 and 25.76 µg/m^3 (Fig.5). In 2011 the winter PM_{10} concentrations reach up to 60.33 µg/m^3, still exceeding the AAN, and the summer concentrations – up to 27.79 µg/m^3 (Fig.6). The correlation is analogous during the rest of the years of monitoring.

The number of days when the average daily human health safety norm (Average Daily Norm /ADN/=50 µg/m^3) is exceeded also supports the seasonal dynamics. Table 1 gives the maximum PM_{10} concentrations and the number of exceeded ADN each month at the urban background station in Varna. The results reveal that the maximum PM_{10} concentrations are at their highest during

the cold months – 109.08 µg/m^3 (2014), 148.75 µg/m^3 (2013), 119.15 µg/m^3 (2012) and 150.64 µg/m^3 (2011). In the summer months, the maximum PM_{10} concentrations are much lower – between 30.24 and 90.36 µg/m^3 during the observation period.

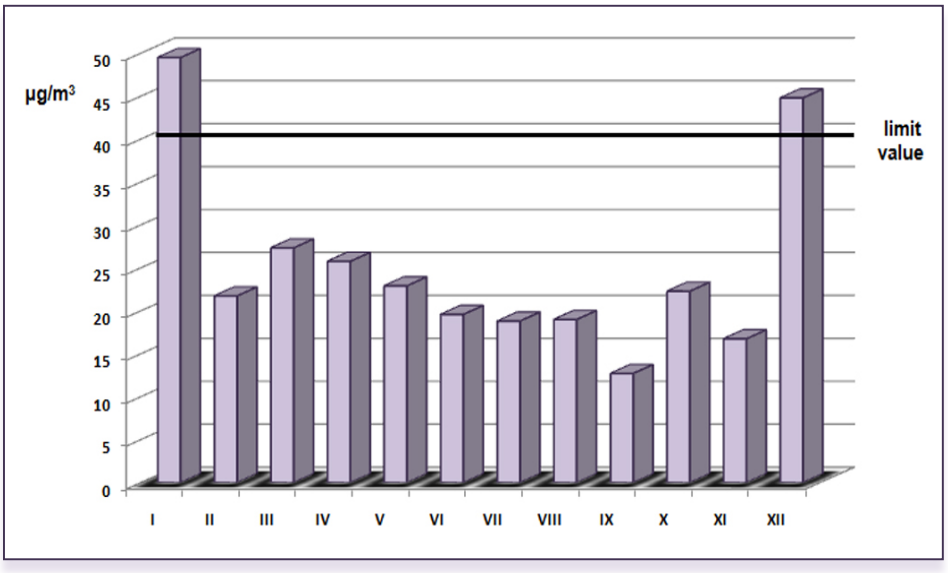

Fig.5. Average monthly PM_{10} concentrations at the urban background station, 2013

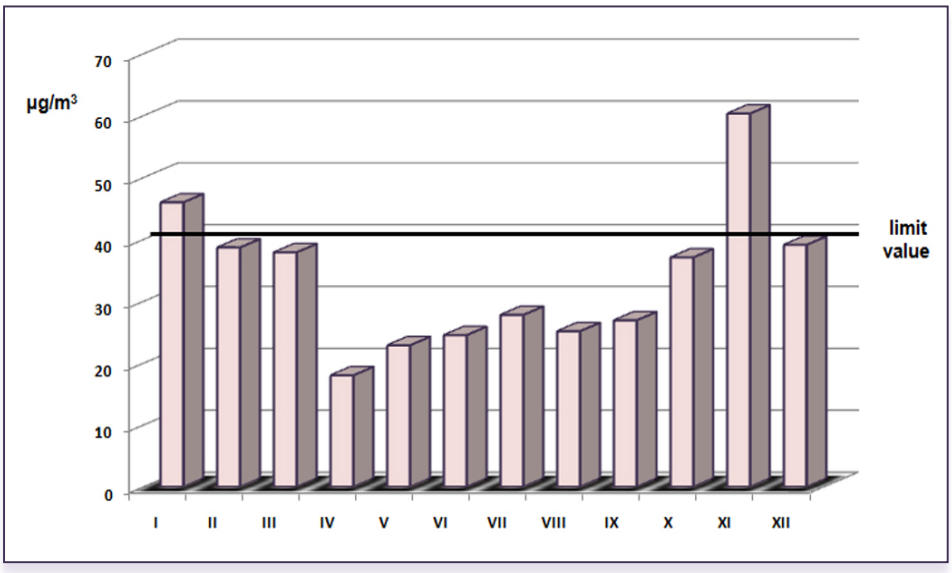

Fig.6. Average monthly PM_{10} concentrations at the urban background station, 2011

Table 1

Maximum PM_{10} concentrations (μg/m^3) and number of exceeded AND at the urban background station in Varna

Years	**2011**		**2012**		**2013**		**2014**	
months	max conc.	number exceed.	max conc.	number exceed.	max conc.	number exceed.	max conc.	number exceed.
January	111.94	15	87.49	6	148.75	14	93.55	3
February	76.42	9	98.96	8	98.37	1	75.44	10
March	91.45	10	58.94	4	65.03	4	92.42	9
April	57.37	1	41.03	0	46.32	0	60.17	3
May	51.62	1	31.28	0	61.29	1	63.87	3
June	44.59	0	37.34	0	30.24	0	44.67	0
July	53.69	2	34.65	0	32.69	0	62.96	8
August	44.70	0	39.01	0	35.62	0	90.36	5
September	62.23	2	32.37	0	35.54	0	105.08	17
October	123.11	10	28.68	0	47.85	0	109.08	14
November	150.64	15	64.58	3	49.40	0	77.86	10
December	112.27	9	119.15	9	97.53	10	82.20	10

Other authors' research of the seasonal PM_{10} variations also establish higher levels during the winter and lower levels during the summer [14]. Maximum concentrations are achieved in January – 118 μg/m^3 (2009), 101 μg/m^3 (2010) and 93 μg/m^3 (2011). In September (warm season) the concentrations are respectively 45 μg/m^3 (2009), 42 μg/m^3 (2010) and 39 μg/m^3 (2011).

The number of days with exceeded ADN during the cold season is also bigger. In 2014 the days ADN is exceeded during the cold season are 56, and during the summer months – 36. In 2013, 29 days are established exceeding the ADN during the cold period and during the summer season – only 1. In 2012 no exceeding of the ADN is recorded during the summer months, and in the winter months they are 29. The situation is analogous in 2011, too – 68 days exceeding the ADN during the cold season and only 6 during the warm season. The data in Table 1 also show a rise in the number of days when the ADN is exceeded by 2014 – 92 as compared to 2012 and 2013 – 30. Such a rise is a worrying fact for the region of the urban background station, which necessitates the undertaking of measures by the municipality for reducing PM_{10} emissions.

The seasonal $PM_{2.5}$ variations in atmospheric air at the urban background station in Varna show that in 2014 the average monthly $PM_{2.5}$ concentrations

during the cold season reach up to 28.33 μg/m^3 and exceed the average annual human health safety norm (Average Annual Norm /AAN/ = 25 μg/m^3) 1.33 times. During the warm period the $PM_{2.5}$ concentrations are lower – between 8.66 and 24.38 μg/m^3. In 2013 the correlation is analogous: $PM_{2.5}$ levels are higher during the colder months – up to 15.32 μg/m^3 as compared with the summer months – up to 8.56 μg/m^{3,}, without exceeding the AAN (Fig.7). Other authors researching the seasonal and diurnal PM_{10} and $PM_{2.5}$ variations in four monitoring stations have also established higher levels of particulate matter during the cold months of the year and especially during the evening – from 18:00 LT until 21:00 LT. In the summer the concentrations are quite lower and monotonous during the whole day (24 hours) [11].

The seasonal differences in the $PM_{2.5}$ and PM_{10} concentrations, forming a peak in the 1st and 4th trimesters (November and March) arise from particulate matter emissions resulting from burning firewood in residential homes and in the heaters in administrative and public buildings during the cold months of the year. These peak values are the combined result of unfavorable meteorological conditions during the cold season (low winds, fogs and temperature inversions) deterring the diffusion and the atmospheric dispersion of particulate matter.

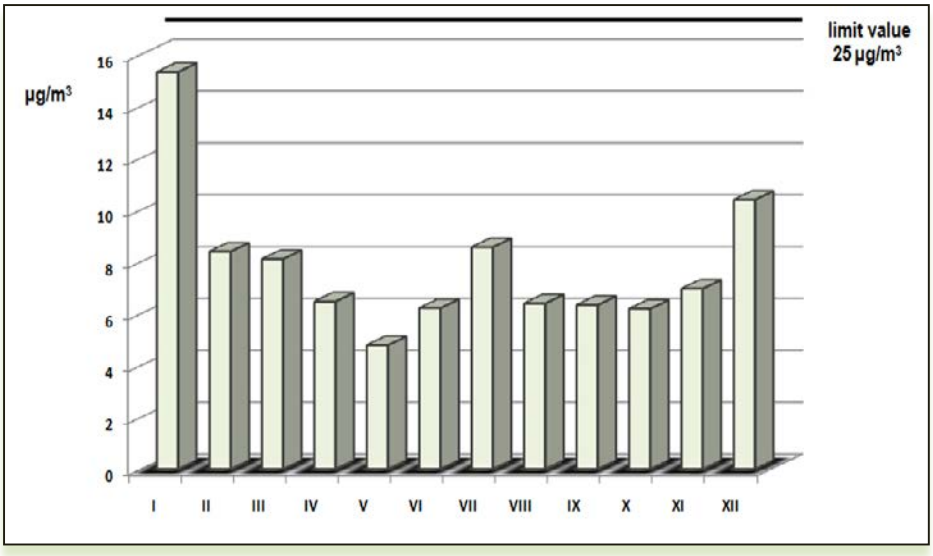

Fig.7. Average monthly $PM_{2.5}$ concentrations at the urban background station, 2013

Other surveys we have made in urbanized territories have established permanent exceeding of the health safety ADN, and the above norm levels of PM_{10} are clearly seasonal. The rising of PM_{10} emissions from residential homes heating within the frame of the general air pollution with particulate matter is connected to the increased burning of coal and firewood to heat homes. Because of the low chimneys and low emission temperature, the share of PM_{10} emissions

from residential heating is the largest for local particulate pollution of the atmospheric air in urbanized territories. (22, 23, 24).

In the transport-oriented station in Varna, the PM_{10} concentrations are rather higher all the year round, yet there is a clear-cut seasonal correlation. In 2014, the average monthly PM_{10} concentrations go up to 70.96 μg/m^{3}, exceeding the AAN 1.77 times, and during the warm period the levels range from 41.16 to 46.66 μg/m^3, and the exceeding of the acceptable norm is between 1.03 and 1.17 times (Fig.8). In 2013 the situation is analogous. There is an above norm all year round pollution, except for the month of June (39.38 μg/m^3) – at the limit of the human health safety AAN. During the winter months, the PM_{10} concentrations go up to 74.17 μg/m^3 – 1.85 times above AAN, and in the summer months the levels are between 40.26 and 53.38 μg/m^3, exceeding the norm 1.33 times (Fig.9). During the rest of the period the correlations are similar – higher PM_{10} concentrations especially between January and March, and between November and December; and lower but still above norm during the summer.

Table 2 gives the maximum PM_{10} concentrations and the number of days when the ADN has been exceeded at the transport-oriented station. From the data, it is clear that in 2014 the maximum PM_{10} concentrations are higher during the winter – up to 163.04 μg/m^3, and in the summer months – they are up to 84.53 μg/m^3. The days when the ADN is exceeded are more – 80 during the cold season and 53 in the summer. The correlations during the rest of the years are analogous. The maximum PM_{10} concentrations in 2013 reach 140.54 μg/m^3 in the winter months and 100 μg/m^3 during the summer months; in 2011 – 178.82 μg/m^3 in the cold season and 99.01 μg/m^3 in the warm period. The maximum PM_{10} concentrations are the highest in 2012 – 221.46 μg/m^3 (cold season) as compared to the warm season – 92.36 μg/m^3.

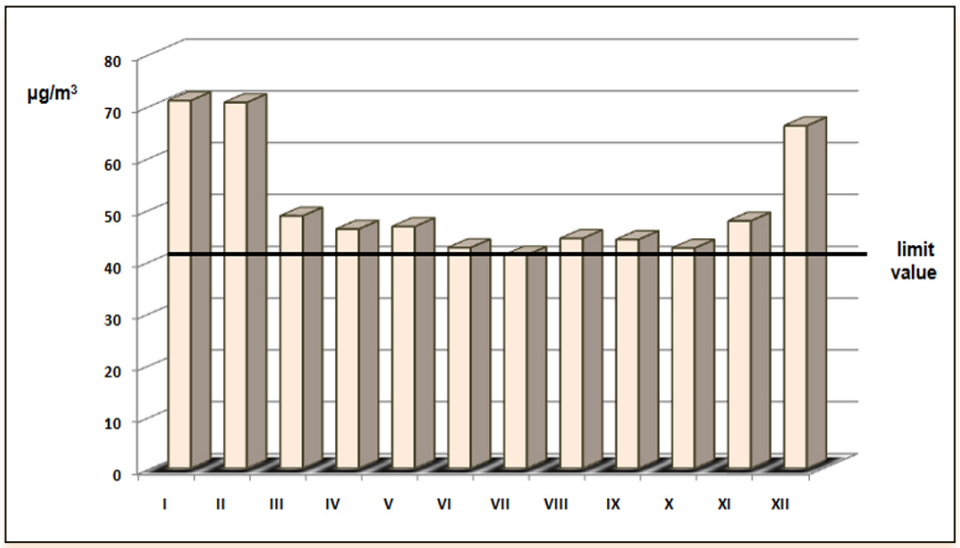

Fig.8. Average monthly PM_{10} concentrations at the transport-oriented station, 2014

The exceeding of the ADN during the rest of the years also shows seasonal correlation – from 90 to 103 days with exceeded norms during the cold months (2011-2013) as compared to 28 – 65 days during the warm months of the year. The analysis of the results in Table 2 shows the traffic-oriented station in Varna behaves more like an urban background station, rather than a typical transport station because of the explicit seasonal correlation in the PM_{10} concentrations in the region.

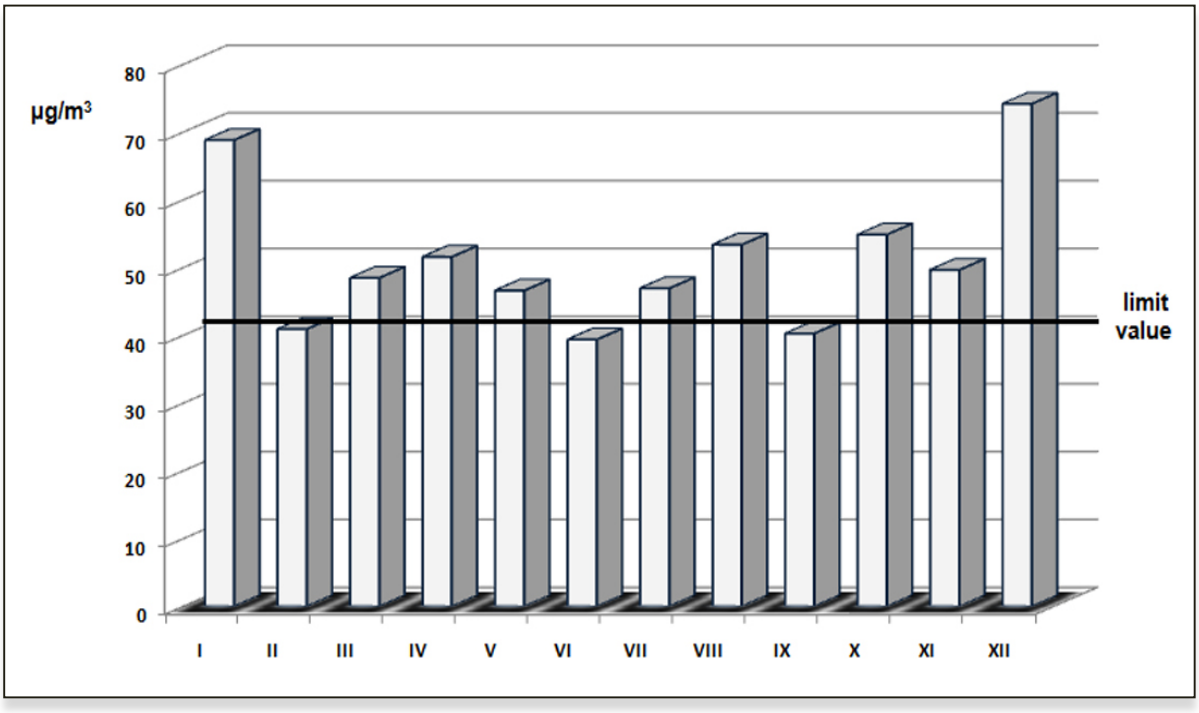

Fig.9. Average monthly PM_{10} concentrations at the transport-oriented station, 2013

Table 2

Maximum PM_{10} concentrations (μg/m^3) and number of exceeded AND at the transport-oriented station in Varna

Years	**2011**		**2012**		**2013**		**2014**	
months	max conc.	number exceed.	max conc.	number exceed.	max conc.	number exceed.	max conc.	number exceed.
January	125.04	21	221.46	19	134.18	19	140.03	22
February	146.43	20	118.09	17	69.67	5	163.04	18
March	125.39	20	10.17	17	95.36	13	94.18	14
April	87.02	5	77.60	8	77.99	15	84.53	7
May	52.62	2	72.04	8	100.75	9	81.60	13
June	55.45	1	61.83	5	60.60	2	68.04	6
July	72.29	5	92.36	16	63.39	14	57.45	6
August	64.24	6	75.35	7	75.92	19	68.61	10
September	99.01	9	60.28	7	73.07	6	61.36	11
October	131.86	11	81.55	13	108.53	16	82.95	7
November	128.17	18	117.34	11	89.01	15	87.06	9
December	178.82	19	126.21	16	140.54	22	101.51	10

Diurnal PM_{10} variations also behave differently during the cold and the warm seasons of the year and delineate different pollution sources. In January (cold season), during the night and morning hours, the PM_{10} concentrations range between 71.82 and 85.93 μg/m^3 and exceed the average daily norm for human health safety (50 μg/m^3). There is no average hourly rate for PM_{10} for comparison and for recording above norm pollution. During the day, PM_{10} levels are lower. In the interval between 08:00 LT and 15:00 LT, PM_{10} concentrations vary from 50.94 to 75.23 μg/m^3, with values at their lowest at 16:00 LT – 41.25 μg/m^3 and at 17:00 LT – 32.14 μg/m^3 (Fig.10). After 18:00 LT, however, the monotony in particulate matter pollution changes. The PM_{10} concentrations gradually rise to 129.13 μg/m^3 (19:00 LT), 159.85 μg/m^3 (20:00 LT), 205.27 μg/m^3 (21:00 LT), with a peak at 22:00 LT – 257.56 μg/m^3. At 23:00 LT PM_{10} levels drop to 211.86 μg/m^3 and at 24:00 LT – to 161.58 μg/m^3. The diurnal fluctuation of the PM_{10} concentrations in January clearly shows the influence of residential homes heating atmospheric air pollution with PM_{10} during the night hours, (after 18:00 LT) as a result of burning firewood and presents the station as an urban background one.

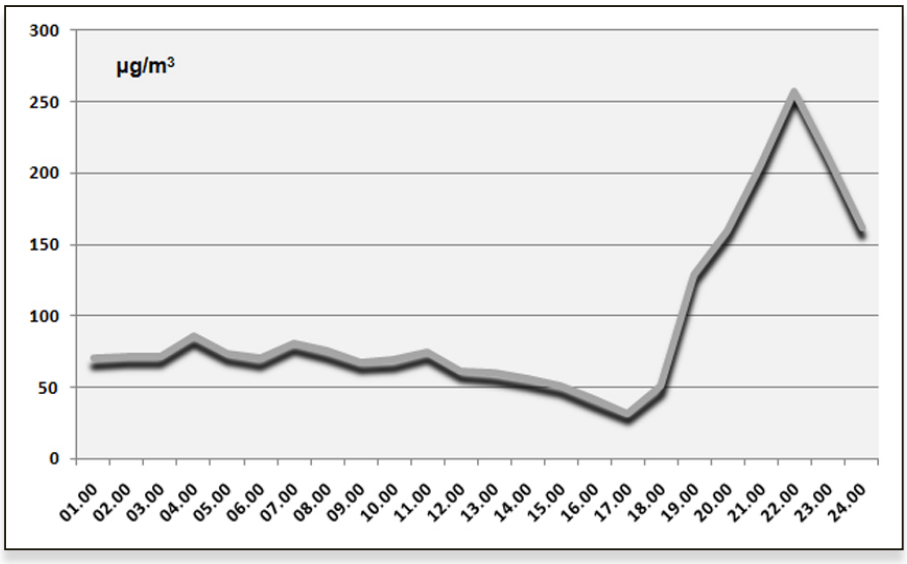

Fig.10. Diurnal PM_{10}variations at the transport-oriented station, cold season

During the summer season the situation differs. The data from September (warm period) show that PM_{10} concentrations during the night vary from 54.81 to 87.20 µg/m^3 (Fig. 11). After 06:00 LT the PM_{10} values gradually rise to 103.20 µg/m^3 and the first morning peak in atmospheric air pollution with PM_{10} is formed. After 09:00 LT the levels fall to 4.14 µg/m^3 and during the day a relatively low and monotonous pollution is maintained – varying between 5.50 and 41.65 µg/m^3. After 16:00 LT the PM_{10} concentrations gradually rise again up to 77.64 µg/m^3 (18:00 LT), 89.86 µg/m^3 (19:00 LT), with a peak at 20:00 LT – 153.79 µg/m^3. After that they start falling again and by 24:00 LT they go down to 29.93 µg/m^3. The two peaks in atmospheric air pollution with PM_{10} clearly define the impact of automobile transport in the region of the station with the characteristic correlation: home-work and work-home from the heavy traffic in the morning and evening hours. During the winter months these interrelations are lost in the influence from other sources – combustion processes (from heating of residential homes and public buildings during the day, especially during the evening hours).

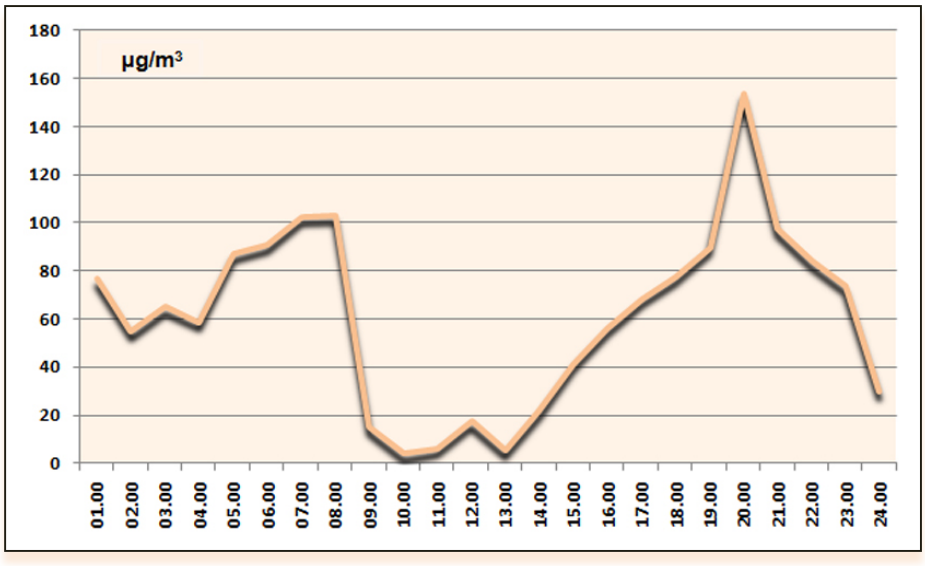

Fig.11. Diurnal PM_{10} variations at the transport-oriented station, warm period

These results show that particulate matter sources in the region of the transport-oriented station in Varna, on the one hand relate to combustion processes during the heating season in residential homes and public buildings when burning solid and liquid fuels – and on the other hand – with emissions from automobile transport. Particulate matter in the fumes from vehicles comes in the form of elementary carbon (soot), sulphuric acid aerosols, unburnt fuel aerosols, as well as some highly dispersive compounds, mostly metal oxides. [5]. Well maintained petrol driven engines have low particulate matter emissions. In the fumes from diesel engines soot and unburnt fuel aerosols form the main type of particulate matter pollutant, which, except for being toxic, also lower visibility on the road. Soot content in fumes from diesel engines can reach $1g/m^3$, especially if the combustion system is not in perfect order.

The soot emitted from diesel engines is a complex conglomerate of highly dispersive carbon particles. Solid carbon is formed after burning in places rich in fuel, because of lack of enough O_2 to form CO_2. The surface of the carbon particles adsorb a large number of organic compounds – originating from the burnt fuel and oils (formed from pyrolysis and cracking), and others are formed from recombination of the hydrocarbon radicals in the process of burning the fuel, as well as adsorbed on their surface sulphur compounds, etc. The metal ingredients from the fuel form a small amount of inorganic soot.

Particulate matter is emitted also during abrasive wear of the road surface from the movement of the vehicles on the surface. The process is mainly connected to the quality of the road surface and the existence of deposit on it. The kinetic energy which the moving tires pass onto the road surface leads to its

wearing off and to emission of particulate matter. In urban conditions these processes become ever more complex because of the existing car traffic and the deposits on the road surfaces. The deposit on the road ends there from different sources and for different reasons. As a whole, this is dispersive solid particulate matter (mostly soil, sand or crumbled road surface). Deposit is only particulate matter with aerodynamic diameter of up to 40 μm. There are many anthropogenic causes of road deposit. One of the main causes for the accruing of deposits on the road surfaces in a given urbanized territory during the winter months is the sanding of the streets and roads to prevent icing. An important factor influencing greatly the levels of particulate matter emissions from road surfaces is also the weight of the motor vehicles.

At the industrial station in Devnya, PM_{10} concentrations are rather lower than the PM_{10} levels at the transport-oriented station in Varna during the whole monitoring period, still the seasonal correlation is preserved. In 2014 the average monthly PM_{10} concentrations during the cold season vary between 33.25 and 40.02 μg/m^3, and reach the average annual human health safety norm (40 μg/m^3) (Fig.12). During the warm period PM_{10} levels are lower – between 19.33 and 32.20 μg/m^3. In 2013, too, no exceeding pollution of the atmospheric air is observed: in the winter months – between 30.26 and 32.26 μg/m^3, and in the summer months – between 19.63 and 30.85 μg/m^3 (Fig.13).

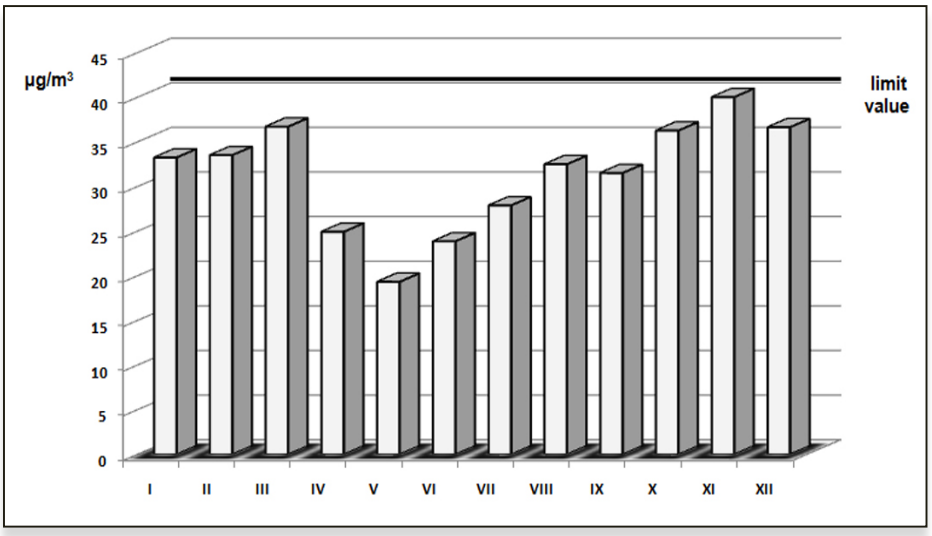

Fig.12. Average monthly PM_{10} concentrations at the industrial-oriented station, 2014

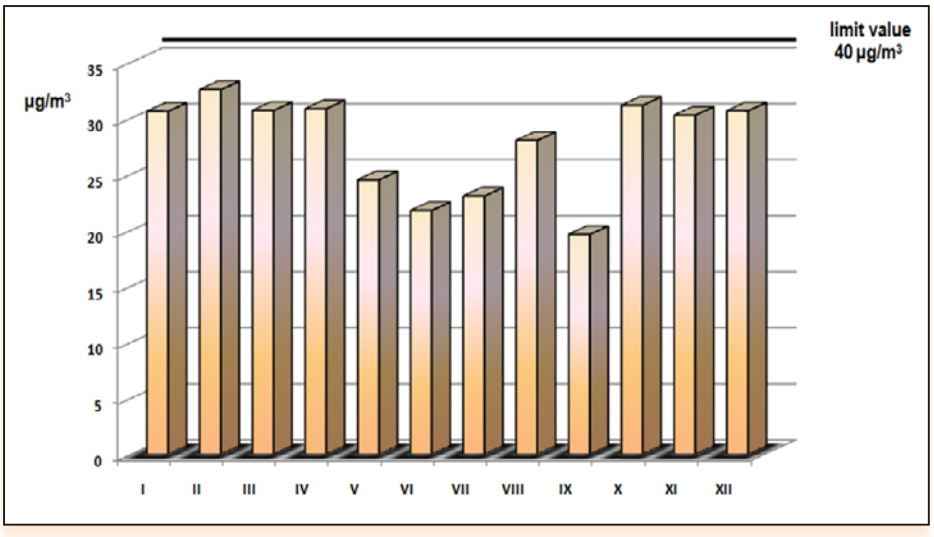

Fig.13. Average monthly PM_{10} concentrations at the industrial-oriented station, 2013

Table 3 shows the maximum PM_{10} concentrations and the number of days when the ADN is exceeded at the industrial station. The results show that the maximum PM_{10} concentrations in 2014 are higher during the cold period – up to 88.19 µg/m^3 as compared to the warm period of the year – up to 50.17 µg/m^3. The number of times the ADN is exceeded during the cold months is also higher – 30, as compared to 1 time during the summer months. The data about the 2011-2013 period are also analogous – between 20 and 30 days when the ADN is exceeded during the cold season and only 1 time during the summer season.

It is noteworthy that at the industrial-oriented station, at the beginning of the survey (2007-2009), PM_{10} concentrations in the atmospheric air are quite higher. In 2007 the PM_{10} concentrations during the cold season reach up to 49.54 µg/m^3, exceeding the ADN 1.24 times. During the summer season the PM_{10} levels continue higher – up to 34.19 µg/m^3. In 2008, the situation is similar – PM_{10} concentrations during the cold months reach up to 50.49 µg/m^3 (1.26 times above the ADN), and in the summer months – up to 40.18 µg/m^3 (at the very norm limit). After 2008, PM_{10} concentrations in atmospheric air at the industrial station region are rather lower, regardless of the fact that an express seasonal correlation is observed.

Table 3

Maximum PM_{10} concentrations (μg/m^3) and number of exceeded AND at the industrial-oriented station in Devnya

Years	**2011**		**2012**		**2013**		**2014**	
months	max conc.	number exceed.	max conc.	number exceed.	max conc.	number exceed.	max conc.	number exceed.
January	80.83	5	57.62	4	76.89	6	69.98	4
February	55.32	2	65.80	6	76.87	3	68.91	3
March	57.81	7	52.32	3	52.68	2	79.54	3
April	29.24	0	28.52	0	43.86	0	50.17	1
May	27.47	0	35.43	0	47.38	0	29.79	0
June	27.51	0	32.26	0	31.00	0	37.87	0
July	35.03	0	45.10	0	33.56	0	43.18	0
August	27.85	0	50.51	1	50.85	1	44.24	0
September	46.30	0	32.27	0	29.49	0	42.61	0
October	50.10	1	41.71	0	68.61	3	56.09	2
November	83.80	7	52.86	2	58.62	3	73.98	11
December	101.62	8	78.57	7	58.65	3	88.19	7

The reason for the decreased levels of PM_{10} in atmospheric air are the introduced complex environmental permits for the industrial and combustion installations in Devnya, as per the 2008/1/EO Directive of the European Parliament and the Council concerning integrated pollution prevention and control [10]. The Directive is transposed in Bulgaria with the Ordinance on the terms and conditions for issuing complex permits [18]. The complex permit guarantees that the best practices will be implemented to minimize the negative impact of the installations on atmospheric air. Suitable measures are proposed, including: alteration in the technological processes and implementation of technology which utilize waste gases; introduction of clean technologies – best existing production methods; substitution of the used raw materials with the aim of reducing emissions; implementation of suitable technology for purifying the smoke and reducing emission in the atmospheric air.

Other surveys we have made have established that in the production and combustion installations in Devnya, after the issuing of the complex permits: (№ 74/2005 of *Solvey Sodi AD*, enforced in 01/2006; № 93/2006 of *Devnya Power Station AD*, enforced in 05/2006; № 68/2005 of *Agropolihim* , enforced in 01/2006; № 63-H1/2007 of *Devnya Cement AD*, enforced in 03/2008) measures are taken to implement efficacious purification installations for the dust emissions, with the aim to improve the quality of atmospheric air in the region [7, 8, 20]. All new facilities conform fully to the best existing techniques and

environmental standards, as well as the reconstruction of those facilities which already exist in the industrial installations. The surveys have established that the implementation of the IPPC Directive and the activities for integrated prevention and control of pollution from big industrial installations is the necessary prerequisite for the improvement of atmospheric air quality.

CONCLUSIONS

PM_{10} concentrations in atmospheric air are at their peak at the transport-oriented monitoring station in Varna and lower at the urban background and the industrial-oriented station. There is an explicit seasonal correlation in atmospheric air pollution with PM_{10} and $PM_{2.5}$ – with higher levels in the colder months and lower levels in the warm months of the year. The seasonal correlation is also confirmed by the diurnal variations of particulate matter.

The EC data about the environment show that there is an exceeding of the average daily human health safety norm in 21 member-countries of the EU in one or more monitoring stations (2). The condition in Bulgaria is the most worrisome – it is the "leader" in PM_{10} pollution of atmospheric air (exceptionally high average and maximum PM_{10} concentrations), as well as $PM_{2.5}$ concentrations. This requires the taking of suitable measures both in urban and industrial areas for decreasing PM_{10} emissions. Programs have been developed for decreasing PM_{10} emissions in both surveyed regions [3, 19]. Measures are delineated for reduction of PM_{10} emissions: from residential homes and transport, and limiting secondary production from stationary points. Measures are included for encouraging the transition to less polluting vehicles; guaranteeing the application of low emission fuels at stationary and moveable sources. As a general measure for lowering PM_{10} emissions from transport, a decrease is planned of the average level of deposits on the roads within the transport map of Varna. The basic measures are taken in three major directions: preventing the bringing of deposit on the roads, systematic cleaning and washing of the transport network and streets, as well as limiting the traffic inside the city. Additional planting of grass is planned in order to enlarge and improve the existing green areas; repair and reconstruction of damaged and low quality pavements, as well as car park surfaces where residents park their vehicles for the night; control of the activities during repair and replacement of sewers and for rebuilding road surfaces; systematic control of construction sites for strict prevention of dust emissions and pollution with construction waste and soil. In relation with the limiting of traffic in the city, for the period 2014 – 2016, the following measures have been planned: renovation and construction of the necessary road infrastructure for relieving the traffic in the central city parts; reconstruction and good quality maintenance of the street surfaces; improving the traffic organization; building new car parks and guaranteeing the creation of

park spaces when new buildings are constructed; limiting the use of personal vehicles through popularizing commuter transport; designing and construction of new bicycle lanes and encouraging bicycle transport.

As for lowering PM_{10} emissions from residential homes, the main measure relates to lowering the consumption of coal and firewood by the residents in both regions. Despite the fact that this is a national issue, local authorities in the surveyed regions can stimulate, within their prerogatives, the increasing of energy efficiency, which will, in turn, lower solid fuel consumption. Suitable measures include: implementation of a local system for control of the solid fuels consumed by the residents, as well as information campaigns on improving energy efficiency of buildings and lowering the use of solid fuels. With the implementation of these measures, a 20% reduction of solid fuel consumption by the residents is expected, which will in turn lead to reduction of PM_{10} emissions in atmospheric air in both regions.

References

[1]. Air Quality Guidelines: Particulate Matter, Ozone, Nitrogen Dioxide and Sulfur Dioxide. WHO Regional Office for Europe, 2006. Geneva.

[2]. Air Quality in Europe – 2014 Report. European Environment Agency, Copenhagen.

[3]. Analysis, Pattern Assessment of Atmospheric Air Pollution, Updating of the Program and a New Action Plan for Reduction of Emissions and Reaching the Required Norms for Harmful Substances in the Atmospheric Air in Varna Municipality: 2014 – 2016.

[4]. Brown M.J. The Health Effects of PM_{10} Air Pollution in Reefton, South Island New Zealand. University of Canterbury, 2009.

[5]. Chuturkova R. Air Pollution, 2015. TU – Varna, p.309, ISBN:978-954-20-0745-6.

[6]. Chuturkova R. Atmospheric Air Quality Management, 2014, TU – Varna, p.248, ISBN: 978-954-20-0603-9.

[7]. Chuturkova R., S. Radeva, M. Stefanova. Assessment of Harmful Emissions in the Atmospheric Air from the Production of Nitrogen and Phosphate Fertilizers. Sustainable Development, 2014, vol. 18, 128-133.

[8]. 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.

[9]. Directive 2008/50/EC of the Europedn Parlament and the Council of 21 May 2008 for ambient air quality and cleaner air for Europe.

[10]. Directive 2008/1/EC of the European Parlament and of the Council concerning integrated pollution prevention and control.

[11]. Fine Particulate Matter ($PM_{2.2}$) in the United Kingdom. Air Quality Expert Group, Croun copyright, 2012.
[12]. Global Sources of Local Pollution: An Assessment of Long-Range Transport of Key Pollutants to and from the United State. Particulate Matter. The National Academies Press, 2009.
[13]. Health Effects of Particulate Matter. World Health Organization, Regional Office for Europe, 2013.
[14]. Li Y., Q. Chen, H. Zhao, L. Wang, R. Tao. Variation of $PM_{10.}$ $PM_{2.5}$ and $PM_{1.0}$ in an Urban Area of the Sichuan Basin and Their Relation to Meteorological Factors. Atmosphere, 2015, vol. 6, 150-163.
[15]. Martuzzi M., F. Mitis, I. Iavarone, M. Serinelli. Health Impact of PM_{10} and Ozone in 13 Italian Cities, 2006. WHO Regional Office for Europe.
[16]. Monitoring Ambient Air Quality for Health Impact Assessment. World Health Organization. Regional Office for Europe, Copenhagen, 1999.
[17]. Ordinance № 12 on the Norms for Sulfur Dioxide Carbon Oxide, Nitrogen Dioxide, Fine Dust Particles, Lead, Benzene, Carbon Oxide and Ozone in Atmospheric Air; State Gazette /*Durzhaven Vestnik*/ issue 58/2010.
[18]. Ordinance on the Conditions and Order for Issuing Complex Permits State Gazette /*Durzhaven Vestnik*/ issue 80/2009, as amended in State Gazette /*Durzhaven Vestnik*/ issue 69/2012.
[19]. Program for Reducing Emissions and Reaching the Required Norms for Harmful Substances in Atmospheric Air (Updating), Devnya Municipality, 2011.
[20]. Radeva S., R. Chuturkova, M. Stefanova. Assessment of Measures for Reduction Harmful Emissions in Air from Soda Ash Production Plant in Devnya, Bulgaria. International Journal of Engineering and Advanced Technology, 2015, vol. 4, No 5, 139-146.
[21]. Takashi Y., B. Sanghynk, K. Saori, T. Toshihide, D. Hiroyuki, H. Yasushi, K. Ho, H. Yun-Chul. Health Impact Assessment of PM_{10} and $PM_{2.5}$ in 27 Southeast and East Asian Cities. Journal of Occupational and Environmental Medicine, 2015. vol. 57, No 7, 751-756.
[22]. Vlaknenski Ts., P. Stoychev, R. Chuturkova. Research on Atmospheric Air Pollution from Particulate Matter in Urbanized Territories of Central North Bulgaria. Sustainable Development, 2013, issue 12, 36-43.
[23]. Vlaknenski Ts., P. Stoychev, R. Chuturkova. Assessment of the Contribution of Particulate Matter Pollution from Pollution Sources on Atmospheric Air Quality in Urbanized Territories in Bulgaria. Sustainable Development, 2013, issue 13, 45–50.
[24]. Vlaknenski Ts., P. Stoychev, R. Chuturkova.. Dispersion Modeling of Atmospheric Emissions of Particulate Matter (PM_{10}) 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.

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ABO BLOOD GROUP AND Rh FACTOR SYSTEM FREQUENCY IN RECEND BULGARIAN POPULATION FROM THE REGION OF STARA AND NOVA ZAGORA

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ABSTRACT: *The present study includes 190 males and females from the region of the towns of Stara and Nova Zagora. Their blood group affiliation to the AB0 and Rh Factor systems are traced. Compared with the control group of Bulgarian population the following differences are established: emphasize differences are registered in group 0 (20% according 31,67% - p<0,001), AB group (11,15% toward 7,59% - p<0,05) and by the positive Rh factor (97,37% toward 84,81%, p<0,01). By the rest of the groups no significant differences are observed. The studied group show considerable differences with the Bulgarian population, which most probably could be due to the ethnogenetic characteristics of the population.*

KEY WORDS: *Stara and Nova Zagora, blood group ABO and Rh factor systems*

Defining the blood type of a population is important not only in routine medical practice but in studying the ethnogenesis of the population of a country. Such studies are even more significant bearing in mind the complex ethnogenesis of Bulgarian people, which is different in different regions of the country. Up to now there have been studies of the blood type of the population in the following aspects: ethnic, in relation to certain diseases, age-related and region-related. The regional studies are scarce and they show clear differences between the regions [1, 2, 3, 4].

Material and methods: The present study involved 190 people - 100 men and 90 women from the regions of Stara and Nova Zagora. Their blood type is defined with reference to ABO system and Rhesus factor. The obtained data were compared to the data of a control group of Bulgarian population [1]. The comparison is made by means of t-criterion. The results are presented in table 1.

Table 1. Distribution of blood types of ABO and Rhesus factor systems in the contemporary population of the region of Stara and Nova Zagora

Groups		O	A	B	AB	Rh+	Rh-
Stara and Nova Zagora n 190	n	38	89	42	21	175	15
	%	20	46,84	22,11	11,15	97,37	2,63
Control group n 1080	n	342	472	184	82	916	164
	%	31,67	43,70	18,04	7,59	84,81	15,19

Aim and tasks: To determine the distribution of blood types in the systems of the studied group of Bulgarian people and to find out if there are any regional differences in this distribution.

Results and discussion:

AB0 system. In the Bulgarian population group studied in the region of Stara and Nova Zagora we found the following distribution of blood types: Type 0 - 20,00%; Type A - 46,84%; Type B - 22,11%; Type AB - 7,59%. In comparison with the control group we found a statistically significant decrease in the presence of blood type 0 (20,00% compared to 31,67% - $p<0,01$), and a statistically significant increase of the relative share of type AB (11,05% compared to 7,59% - $p<0,05$). In the other two blood types of our sampling we registered higher values in general but the differences were not significant (Table 1, Figure 1).

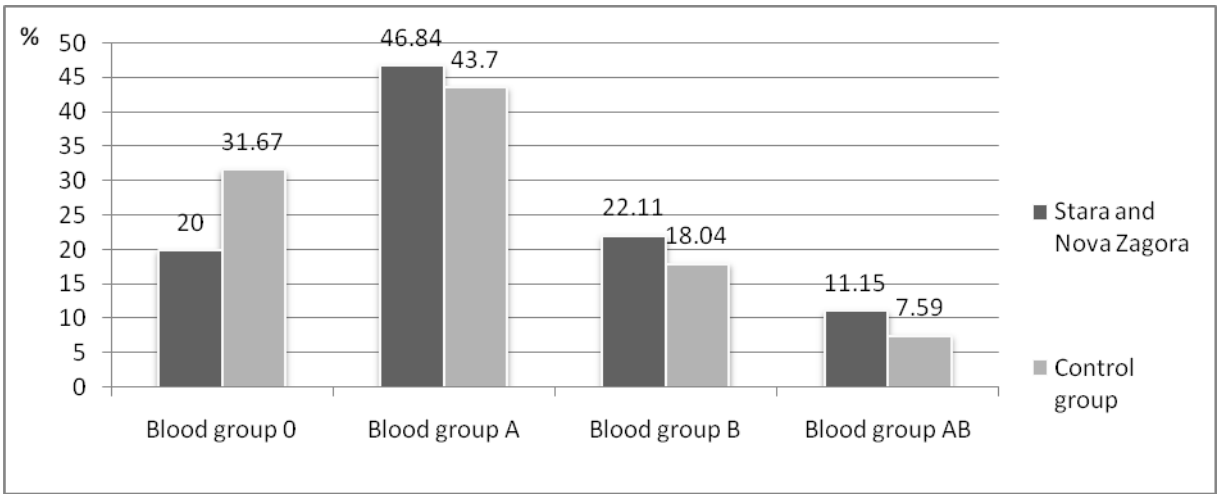

Figure 1. Distribution of blood types of ABO system in the contemporary population of the region of Stara and Nova Zagora (%)

Rhesus factor system. In studying the sample from the region of Stara and Nova Zagora we found the following distribution of the types of Rhesus factor: positive - 97,37% and negative - 2,63%. In the control group of Bulgarian population the values are 84,81% and 15,19% respectively. The comparison reveals a statistically significant increase in the positive Rhesus factor (97,39% compared to 84,81%,p<0,001) (Table 1, Figure 2).

In the data analysis of the distribution of blood types in the ABO system we found a statistically significant increase in the relative share of people with AB type blood (p<0,01) and a relatively higher presence of B type. These results give us reason to suppose the presence of Eastern ethnic elements in the ethnogenesis of the population in the area studied. The results for the Rhesus factor system show that there are considerably fewer people with negative rhesus factor than positive in comparison with the control group of the Bulgarian population (p<0,05).

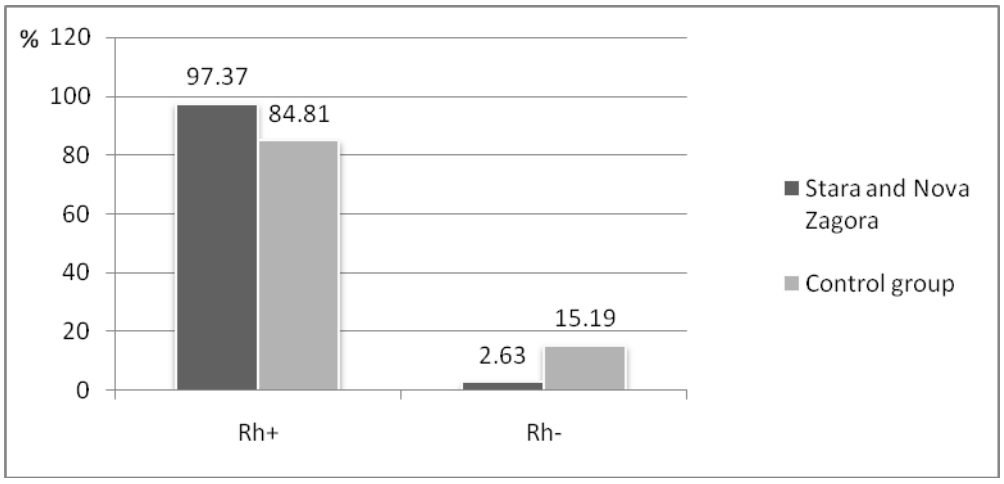

Figure 2.Distribution of Rhesus factor in the contemporary population of the region of Stara and Nova Zagora (%)

The facts established regarding the distribution of blood types in both systems lead us to conclude the existence of mongoloid elements in the ethnogenesis of the population in the studied region of the country, which is significant compared to the control group.

Conclusions:

1. In the studied sample we have identified a statistically significant decrease in the relative share of 0 blood type and the negative Rhesus factor as well as a statistically significant increase of AB blood type.
2. The results of the study of blood types imply the existence of mongoloid elements in the ethnogenesis of the population in the region studied.

References

[1]. Todorov, V., Promene antropoloških karakteristika u toku starenja, Doctorate thesis, Belgrade 1998-1999, 72-77.
[2]. Todorov, V.; Minkov, Ts.; Tosheva, N.; Minkov, B., Blood group characterisation of bulgarian population from the regions of Panagurishte and Strelcha, Journal of the anthropologycal society of Serbia, 2009, 44, 483-489.
[3]. Todorov, V.; Daskalova, V.; Maksimova, S., Karakteristika krvnih grupa kod stanovništva Devinskog regiona, Journal of the anthropologycal society of Jugoslavia, 1996**,** 2, 29-32.
[4]. Todorov, V.; Minkov, Cv.; Toševa, N., Distribucija krvnih grupa ABO i Rh sistema kod recentnog stanovništva grada Petriča, Journal of the anthropologycal society of Serbia, 2011,46, 173-177.

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NORMATIVE REGULATION OF SOCIAL RELATIONS ARISING FROM DISASTERS

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ABSTRACT: *According to the National Institute of Meteorology and Hydrology of the Bulgarian Academy of Sciences, the Strategy for disaster risk reduction 2014-2020 and others, in the coming decades is expected to grow the frequency and scale of natural disasters. More frequent and severe storms and hailstorms, floods, landslides, long-lasting droughts and extreme temperatures, devastating wildfires may have a significant adverse impact on society. It is therefore necessary adaptation to the risks associated with climatic extremes.*

KEYWORDS: *adaptation, risks, disasters, politics, statutory regulation.*

Introduction

In recent years reducing the risk of disasters has become a global priority. Evidence of that are the international documents adopted by member states of the European Union (EU) and the Hyogo Framework for Action (Kyoto) 2005-2015 of the United Nations "Building resilience of nations and communities to the disasters" [7], which calls and defines every single country to be responsible for creating a National platform and Strategy for reducing disaster risk (SRDR). In this regard, and after following the changes in the Law on Disasters from 2011, was created an Advisory Board to the Council of Ministers (CM) of the Republic of Bulgaria. Its main task is to assist the Council of Ministers in carrying out state policy in the field of disaster protection.

In this regard, the purpose of this report is:

1. To set out the main documents in the field of reducing the risk of disasters.
2. To define the responsibilities in case of natural disasters and to make clear personalization of their execution.

Exposition:

The report is structured as follows:

1. Responsible bodies for reducing disaster risk

2. Analysis of the mechanisms for modeling disaster protection in Bulgaria.

The main documents of the EU in the field of reducing the risk of disasters are [4, 7, 8]:

– the Council Decision establishing the Mechanism of the EU Civil Protection;

– council Directive 2007/60/EC on the assessment and management of flood risks;

– council Directive 96/82/EC on the control of major-accident hazards involving dangerous substances;

– council Directive 2008/114 / EC on the identification and designation of European critical infrastructures and the assessment of the need to improve their protection;

– directive of the European Parliament and the Council of Europe establishing an infrastructural spatial information in the community / INSPIRE /, which as an EU Member State, Bulgaria transposes.

Other important documents for the balanced approach of the EU and the principle of national responsibility of Member States for disaster prevention are the Council conclusions on "Community framework for disaster prevention in the EU", "Towards strengthening the EU's response to disasters: the role of civil protection and humanitarian assistance ", "Raising public awareness in the field of civil protection" and "Development and implementation of early warning systems in the EU" [4].

An important international document for Bulgaria and Southeastern Europe is the Memorandum of Understanding on the institutional framework of the Initiative for Disaster Preparedness and Prevention Initiative for South Eastern Europe (DPPI SEE) [8] and the adopted every second year Strategy and Action Plan of the Initiative. The purpose of these documents is an effective regional approach to managing disasters and emergencies by analyzing the current situation, available capacity, challenges and opportunities for enhancing regional cooperation on preparedness and prevention [7].

The main legislation in the Republic of Bulgaria, governing the reduction of disaster risk and regulating the obligations of the ministries, departments and organizations are: Law on Disaster Protection, Water Act, the Ministry of Internal Affairs, Law on Spatial Planning, Law on Waste Management , Law on safe use of nuclear energy, Law on Environmental Protection, Law on Administration, Law on Health and safe labor conditions, Law on Defense and Armed Forces ,State Reserves and Wartime Stocks Act, Protected Areas Act, the Cultural Heritage Act, Forest stocks Act, Act of oil and oil product stocks, the Access to public information Act, Law on Protection of Classified Information, Bulgarian

Red Cross Act, the Plant Protection Act, Bulgarian Agency for Food Safety Act, The International Plant Protection Convention, Law on the protection of agricultural land, the National Emergency Call System Using Pan European Number 112, Law on the protection from the harmful effects of chemical substances and mixtures, Health Law, Law on Local Government and Local Administration and the secondary legislation to them [4].

The institutions are currently working on the National Program for Disaster Protection, 2014-2018 (NPDP), which is an important document in the field of disaster risk reduction and it is continuation of the National Program 2009-2013.

Structures in charge for reducing disaster risk

Reducing disaster risk reflects the moral and social responsibility of all management levels. Serious responsibility in the management of disaster risk requires strict public definition of responsibilities and clear personalization of their implementation.

In Bulgaria, the executive, legal entities and types of traders organize disaster protection in the execution of their duties according to the Law on Disaster Protection, The National Program for Disaster Protection, 2014-2018, and the above mentioned regulations.

The Council of Ministers develops and implements the state policy in the field of planning, prevention, tackling and overcoming the effects of disasters and accidents, aimed at establishing an effective and secured by resources NPDP. Bulgarian membership in EU and NATO puts additional requirements concerning the construction of integrated mechanisms and procedures by 2016 [5].

The Interdepartmental Commission for Reconstruction and Assistance (ICRA) to the Council of Ministers is the body that decides to finance activities to prevent, control and overcome the consequences of disasters.

The functions and activities on disaster protection are carried out by the General Directorate "Fire Safety and Protection of Population" (GDFSPP) to the Ministry of Interior (MoI), which is a national specialized structure for fire safety, rescue and disaster protection under the Ministry of Interior Act and the Law on Disaster Protection [3, 4].

The activities on prevention or reducing the effects of natural or man-made disasters are regulated in the Annual Implementation Plan of the National Program for Disaster Protection 2014-2018 and in the following areas [8]:

– actions on reducing the effects of earthquakes;
– activities on prevention or reducing the effects of flooding under Directive 2007/60/EC on the assessment and management of flood risks and for conducting effective preventive actions;
– activities for mitigation of the consequences of a radiological emergency;
– activities on prevention or reducing the consequences of landslides;
– activities on prevention or reducing the effects of large fires;
– activities for reducing losses in agriculture due to adverse climate impacts;

– activities providing the Unified Rescue System.

Analysis of mechanisms for modeling disaster protection in the Republic of Bulgaria

An important document in the field of reducing the risk of disasters is the National Plan for Disaster Protection, which is being developed under the leadership of the Minister of Interior, with the participation of representatives of the ministries, departments, local authorities and NGOs [4].

Furthermore, the Law on Disaster Protection provides that activities on disaster protection to be planned according to the approved in the country management model on national, regional, municipal and object level. All regional and most of the municipal and departmental plans for disaster protection are periodically updated.

With the introduction of the Directive on European Critical Infrastructures in the Law on Disaster Protection [2, 4, 7], regulatory framework has been developed for disaster sites, representing national and European critical infrastructures, risk assessment and measures to improve their protection. As for the sites, against which could be directed some of the risks and threats to security, they practically could be in any area.

To ensure public access to emergency services in the Republic of Bulgaria operates Unified Rescue System (URS) to the structure of the Ministry of Interior. The system provides the opportunity for gradual attraction of forces and means in accordance with the development of the disaster through the SEECN 112 [3].

A national system for early warning and alert (National siren warning system) has been adopted for disaster and risk disclosure in the air. It consists of two subsystems - one aimed at population, and the other - at the executive authorities and the constituents of the URS [4, 7].

The siren system or NSWS of the population is aimed at citizens. It creates an opportunity for simultaneous alarming of large groups of people of impending or actual disaster. For the alarming of air danger is established a national danger alert signal.

The notification system for alarming the authorities is built and structured on four levels - national, regional, municipal and local. The system is aimed at the alarming of a wide range of officials - heads of central institutions, regional coordination offices, mayors, municipal coordination headquarters and parts of the URS. The notification system for alarming the authorities is built and structured on four levels - national, regional, municipal and local. The system is aimed at the alarming of a wide range of officials - heads of central institutions, regional coordination offices, mayors, municipal coordination headquarters and parts of the URS. With its capabilities, this system ensures quick mobilization and conditions for an adequate response of all competent officials, and improving the coordination of the executive authorities and the emergency forces at national, regional and municipal level.

Through the period 2010-2013, in the Cross Border Cooperation Program Romania-Bulgaria, was realized the project "Danube cross border early warning system for earthquakes" (DACEA),

Fig. 1. The Danube early warning system for earthquakes

with major partners - the National Institute for Research in Physics of the Earth, Bucharest, and the National Institute of Geophysics, Geodesy and Geography to the Bulgarian Academy of Science, Sofia. As a result, in Northern Bulgaria [4] was built the Danube early warning system for earthquakes, including 8 seismic stations and 8 alarm systems (Fig. 1).

In 2012 was completed the preliminary assessment of flood risk for each region with basin management [6, 9]. A description and evaluation of past floods was made, as well as an assessment of the potential threat of future floods and an assessment of their adverse effects. In 2013 was completed the methodology for assessing the risk of flooding - the methods and criteria for determining the areas with a significant flood risk, and the methodology for assessing the risk of flooding in accordance with Directive 2007/60/EU. Defined and established were the areas with a significant risk of flooding in the country, for which were made maps of the threat and the risk of flooding. Based on the cards, plans for managing flood risk and programs of measures to reduce the risk for a period until the end of 2015 are expected to be developed.

So far 163 simulation models have been prepared. The graphic materials, presented here, are related to simplified models for simulation of floodplain areas due to potential floods. The maps were made by specialists from the Center for Remote Sensing Application (ReSAC), the Agency for Sustainable Development and European Integration (ASDE), specialists from Sofia University "Sveti Kliment Ohridski" and the National Institute of Meteorology and Hydrology (NIMH) [6, 7].

In 2011 was adopted the national emergency plan to deal with oil spills in the Black Sea [4], in compliance with the requirements of the international

conventions. The plan regulates the actions of the responsible Bulgarian institutions to fight accidental spills at sea and to minimize their environmental and economic consequences.

In 2012 was adopted an external emergency plan of the Nuclear Power Plant "Kozloduy" EAD [4]. The document contains an analysis of possible accidents involving the release of radioactive substances into the environment, the organization of emergency response, short-term and long-term measures to protect people, the environment and cultural values, as well as activities to ensure the utilization of the plan.

The Center for Aerospace Monitoring (CAM) to the National department "Fire Safety and Protection of Population" of the Ministry of Interior is intended for forecasting, early warning and monitoring of emergency situations on a national scale. The center provides reception and processing of aerospace data and allows for real-time monitoring of the occurrence of disaster in the country and in the region. The data can be used for evaluations and analyzes of both natural disasters and in the field of hydrology, meteorology, climatology, oceanology, ecology, agriculture, anthropogenic pollution of water and atmosphere, infrastructure and others [4].

In this regard, more and more attention is paid to the programs developed under the leadership of the EU and the European Space Agency, related to Earth Observation (ESA), geographical information systems (GIS), the Global Positioning System (GPS) and remote sensing, unification of databases, methodologies and others. EU countries are increasingly cooperative in the field of security as they provide information related to the risks of crises and support rescue operations in case of natural disasters [4, 6, 7].

In November 2011 the US satellite for Earth observation NPP was put out in orbit - that is the next generation of satellites TERRA and Aqua, from which the Center for Aerospace Monitoring (CAM) receives data.

As of early 2014 Project MARINGEOHAZARDS has been started – putting into operation and enhancing the effectiveness of the warning system of marine hazards. The project is the result of bilateral cross-border cooperation with Romania, the Institute of Oceanology to Bulgarian Academy of Science is the responsible institution for Bulgaria [4].

Work is under way for building a system for seismic monitoring in the area of the town of Pernik, with a deadline for commissioning – 2014.

A legislative intervention to regulate the information and messages of occurring earthquakes and other related disasters in real time is to be adopted.

Despite the numerous projects and programs developed, and the available funds for prevention, practice shows a certain lack of preparedness for meeting a major natural disaster. The reasons are probably in:

– limited and scattered data on disasters;

– insufficient awareness of the population about the activities in disaster risk reduction, as well as their reactions in case of disaster;

– coordination between responsible institutions at national, regional, municipal and local level;

– long - term planning of the management of disaster risk.

Conclusion

According to the National Institute of Meteorology and Hydrology - BAS, the Strategy for disaster risk reduction 2014-2020, etc., in the coming decades is expected the growth of the frequency and scale of natural disasters. More frequent and severe storms and hailstorms, floods, landslides, long-lasting droughts and extreme temperatures, devastating wildfires - they all may have a significant adverse impact on society. It is therefore necessary an adaptation to the risks associated with climatic extremes.

Essential for the management of natural disasters are the properly identified and defined risk factors and threats. The increase of the different by nature emergencies throughout the country puts more strongly the questions about the effectiveness of the forecasting and planning at national, institutional, regional and local level. The coherence of the plans for disaster management is a prerequisite for the rational use of national resources, for the protection of the life, health and property of the citizens [1].

In Bulgaria, the executive authorities, the legal entities and types of traders, organize disaster protection in the execution of their duties by the Law on Disaster Protection, The strategy for disaster risk reduction, The National Program for Disaster Protection and other regulations.

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References:

[1]. EU Community approach on the prevention of natural and man-made disasters, Brussels 2009, 11p.

[2]. Law on Disaster Protection, as amended in the State Gazette, issue 14/2015, 37 p.

[3]. Law on National Emergency Call System SEECN 112, as amended in the State Gazette, issue 88 /2010, 10 p.

[4]. National Program for Disaster Protection 2014 – 2018, Council of Ministers at Republic of Bulgaria, Sofia 2013, 73p.
[5]. National Security Strategy of the Republic of Bulgaria, Sofia 2011, 22p.
[6]. Preliminary assessment of flood risks in the Black Sea Basin, Ministry of Environment and Water at Republic of Bulgaria, BSBD Varna 2012, 116 p.
[7]. Strategy for disaster risk reduction 2014-2020, Council of Ministers at Republic of Bulgaria, Sofia 2014, 30p.
[8]. The annual plan for 2014 for implementation of the National Program for Disaster Protection 2014-2018, Council of Ministers at Republic of Bulgaria, Sofia 2013, 28p.
[9]. Water Act, as amended in the State Gazette, issue 61/2015, 181p.

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ANALYSIS AND ASSESSMENT OF THE RISK OF NATURAL DISASTERS

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ABSTRACT: In recent years, the policy of reducing the risk of disasters is a top priority for many countries in the world, including Bulgaria. A key factor in solving issues related to disaster risk reduction, is the existence of political commitment at all levels.

KEYWORDS: *analysis, assessment, risk, disaster.*

Introduction

Reducing the risk of disasters requires strong institutional basis, which can be supported through capacity building, good governance, promotion of appropriate policies to facilitate the flow of information and the adoption of effective coordination mechanisms. Knowledge of hazards, especially in increasing variance and instability of the climate allows for a better understanding of risks, their management, increasing responsiveness and minimize adverse impacts. Information on the economic impacts of disasters is also important as it enables the assessment of costs and benefits of various measures for disaster prevention.

In this regard the purpose of the report is as follows:

1. To analyze the concept of risk.
2. To assess the risk of natural disasters.

Presentation

Everyone, depending on their experience and the environment in which they exist, has a different idea and attitude to risk. Different types of activities and professions define the concept of risk differently.

Risk can be defined as a combination of the probability of a certain event and its consequences [10].

The Seveso II Directive defines risk as "the likelihood of a specific effect occurring within a specified period of time or under certain circumstances." As such, the risk is a complex function of the hazards associated with a particular system. Acceptability of certain risks depends on many aspects such as control, fear, knowledge, confidence.

Risk is the probability of occurrence of adverse event or process related to human activity that is subject to rationalization and management [7].

Risk has the following main elements: threat, vulnerability, impacts, sources of risk and risk factors.

Risk factors can be qualitatively and quantitatively evaluated. Proper identification and definition of risk factors is a criterion for good security situation. It also helps to effective risk management, which is expressed in the ability to anticipate threats and minimize their adverse effects.

In risk management two types of strategies are implemented – preventive and powerful. The prevention strategy builds effective protection or transfer of risk to avoid its manifestations. The powerful strategy actively influences the risk in order to minimize it or its mitigation and eventual realization of new opportunities arising in consequence of the event of risk. The choice of management strategy depends on the capacity, resources and the existing dependencies and conditions [11] (Fig. 1).

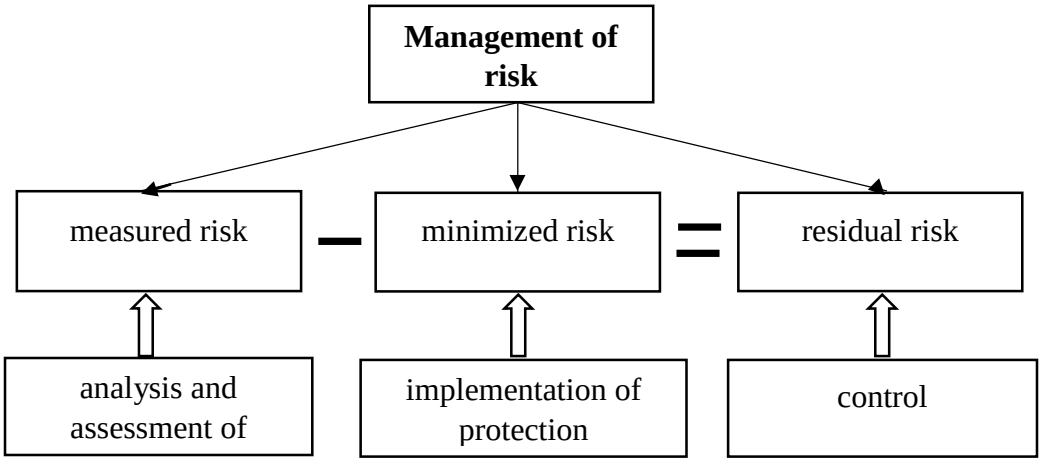

Fig. 1. Management of risk

There are different views on the specifics of the process of risk management. In international management standards, it is assumed that regardless of the parameters and scope of the various systems, the process of risk management goes through four stages [1, 4, 6, 9]: hazard identification, assessment and hazard analysis and risk evaluation, establishment of control and enforcement of management-impact, risk monitoring (Fig. 2). In a number of sources of risk analysis, the identifying activities and risk assessment are considered as separate stages.

The modern concept of risk management requires the risks and threats to be managed effectively. This can be done through proper identification of hazards.

Hazard analysis is the process of understanding the nature of risk and determining its level. It provides the necessary information about the current situation, including the actions taken to each of the identified hazards, based on which a subsequent evaluation will follow. Through the analysis the identified hazards are systematized. Taking into account the estimated effects and the frequency of implementation of any hazard, it is possible to give priority to certain hazards.

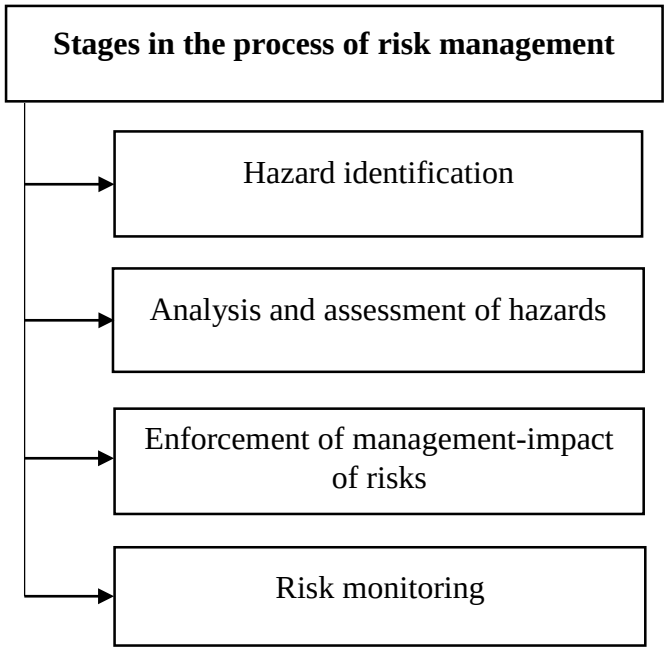

Fig. 2. Stages in the management of risk

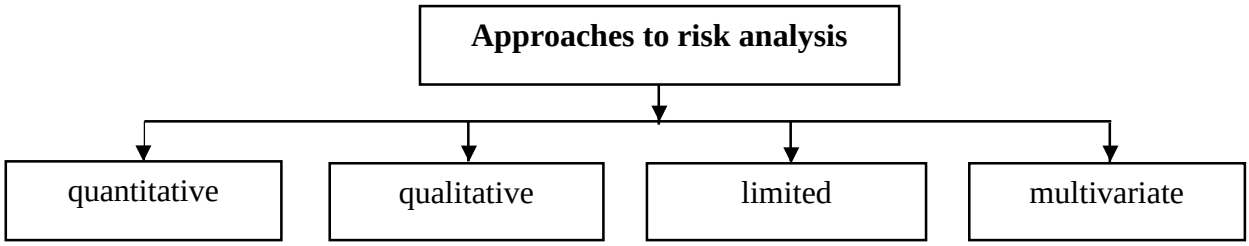

Fig. 3. Types of approaches for risk analysis

There are various approaches to measuring risk [3, 9 … 11] (Fig. 3):

– quantitative risk analysis - mathematical evaluation (statistics, modeling), the risk is measured in monetary losses or as a set of the value of the losses in the frequency of their manifestation;

– qualitative risk analysis - expert assessment, the risk is measured qualitatively using degrees or levels;

– limited approaches - considered is only a limited number of components;

– multivariate approaches;

– combinations of approaches.

Each approach has its application area, both positive and negative aspects, but the most commonly used are the quantitative and qualitative approaches for risk assessment.

The quantitative approach is mostly used for risk assessment in specific manufacturing processes, using the methods of mathematical modeling and statistical calculations. This approach requires multiple and different types of technical trials, experience and very high qualifications of the persons who use it. It is characterized by a higher degree of detail, which enables the assessment of its impact on the realization of the objectives by criteria such as content, quality, time losses, resources, etc. The disadvantage of the quantitative analysis is that it is sometimes difficult to identify the relationships between events and threats, the calculated values are subjective, it encourages inaction over the real significance of certain risks [8, 9, 10].

The qualitative approach allows the use of heuristics to identify threats, vulnerabilities and impacts. Qualitative risk assessment allows their classification in order of importance for the organization and for determining whether any risk to be detained or transferred. For example, the probability of occurrence of the risk is assessed as "high", "medium" or "low", the exposure, as "low", "medium" or "high", and the consequences as "medium", "significant" and "disastrous". For this purpose, ordinal scales are used [10, 11].

The risk assessment (determination of the risk level) is performed from the perspective of likelihood and impact. In its essence, this stage is the most complex and lengthy, as the risk assessment is not a single action, but it is rather performed periodically in the course of managing. Risk assessment is linked to prioritizing of risks in order to determine their importance and priority. It supports the decision to impact on risk. The results of the risk assessment are the basis of all other activities in the process of its management.

The calculation of the adverse effects is related to the measurement of damages, which should lead to their calculation in natural form by a certain method. To do so, we have to determine an appropriate measure by which to express the impact of risk. As the main purpose of risk management is to ensure the stability, it is best the severity of the damage to be expressed in monetary form. No matter that it is difficult to express moral damages in money, the incidence of damage is calculated using probability.

To assess the significance of the risk is accepted the numerical expression of the prioritizing the likelihood, frequency and the severity of the damage [5, 8, 9]. The Belgian system is adopted to define risk (R), as the value of the assessment consists of three parameters – likelihood (L), frequency (F) and consequences (C).

$$R = L * F * C. \quad (1)$$

The likelihood of damage being caused (occurrence of certain consequences) is determined by the grades in (Table 1) and the factors:

– frequency, duration and specifics of exposure;

– probability of occurrence of a particular event;

– technical possibilities to limit or avoid the damage;

– person's possibilities of avoiding or limiting the damage (qualification, experience practical experience and skills, etc.);

– values of the parameters of the working environment.

Table 1: Degrees to determine the likelihood

Likelihood (L)	**degree**
Barely noticeable	0,1
Practically impossible	0,2
Least possible	0,5
Less possible, yet possible in limited cases	1,0
Low likelihood	3,0
Completely possible	6,0
High likelihood	10,0

The frequency of exposure indicates how often a risk is probable to occur, and how often the system is threatened by accidents. For quantitative evaluation the grades in the (Table 2) are used.

Table 2: Grades to determine the frequency

Frequency of exposure (E)	**grade**
Very rarely (less than once a year)	0,5
Rarely (once a year)	1,0
Sometimes (once a month)	2,0
It happens (once a week)	3,0
Regularly (daily)	6,0
Constantly	10,0

The consequences are undesirable results from an event or series of events. The severity of the injury is assessed according to: the type of objects to be protected (people, property, labor and environment); severity of possible injuries or damage to health; extent of injury (Table 3).

Table 3: Grades to determine the impacts

Impacts (I)			
1,0	Minimal	First aid measures, no loss injury	Damages amounting to € 10,000
3,0	Significant	Serious injury with losses	Damage from €10,000 to €1,000,000
7,0	Severe	Disability, irreversible injury	Damage from €100,000 to € 1,000,000
15,0	Rather severe	Fatal case, serious illness	Damage from €1,000,000 to € 2,000,000
40,0	Large scale	Several deaths	Damage from €2,000,000 to € 20,000,000
40,0	Devastating	A lot of deaths	Damage over € 20,000,000

Risk is calculated based on the parameters specified by (1). Depending on what part of the boundary interval falls the calculated ranks number, classification of the risk is made (Table 4). This is done to determine the point of admissibility and the need to implement countermeasures.

Table 4: Risk classification

Risk	Decision	Actions
R < 20	Minimum risk - the risk is negligible and is not expected to increase in the near future	No actions required.
20 < R < 70	Acceptable risk - the risk is controlled to an acceptable level. May increase in the future, but there is no evidence for an increase.	Requires attention.
70 < R < 200	Moderate risk - inadequately and ineffectively controlled risk.	Measures needed to be taken to reduce it.
200 < R < 400	Significant risk - ineffectively controlled risk.	Immediate measures to prevent and control exposure to this risk.
R > 400	Unacceptable risk.	It is necessary to break the activity and the risk to be eliminated.

When assessing the risk is determined whether it and / or its magnitude is permissible or acceptable (Fig. 4). As acceptable risks are defined those that do not require the application of

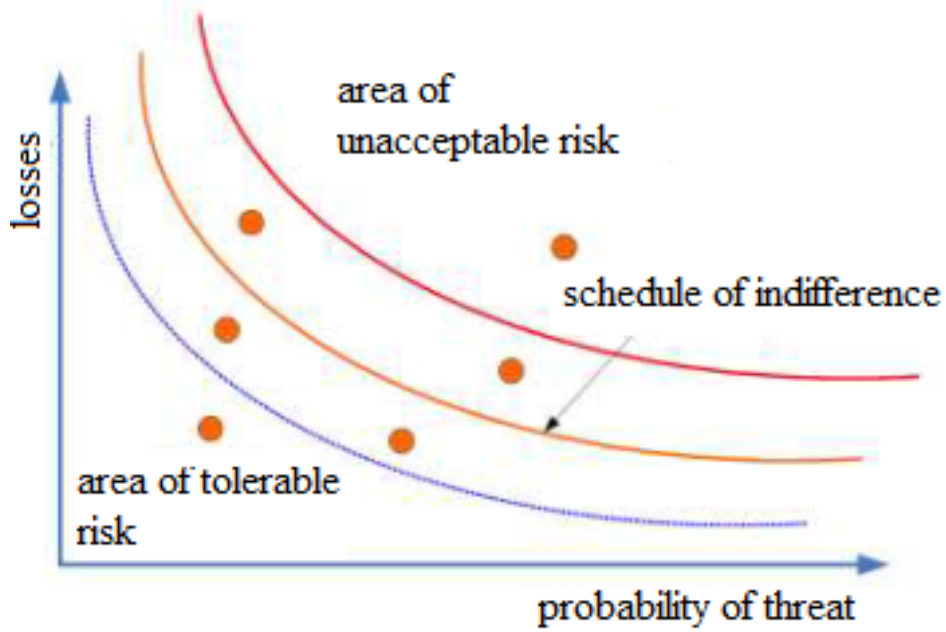

Fig. 4. Curves presenting the areas of risk, depending on the probability and losses

measures to reduce their impact. At the same time their amendment is continuously monitored - "area of tolerable risk". As deprecated risks are defined those ones that are non-essential or non-existent. As significant risks are defined those that should have priority - "area of unacceptable risk." In some cases, the risk could be very high and it may require reassessment of the overall activity [2].

After the assessment is ready, a record or risk profile of the identified risks is made, which according to ISO / IEC Guide 73: 2009 [6, 9, 10] is a documentary form of entry of the risks and their qualitative and quantitative characteristics. Through it are determined the priorities in management activities, control methods, areas of responsibility, and necessary for their management resources.

Counteracting risk. In the process of prioritizing risks, the frequency, probability and consequences are compared to the estimated costs necessary to counteract risk. The area in which risks fall is determined - area of high priority, surveillance area and a low priority area. Thus the risks are prioritized by identifying those ones that necessarily should be treated. As of risks, falling in the area of high priority, obligatory measures must be taken. Risks from the monitoring area are monitored periodically and the mechanisms and actions through which these risks are maintained within acceptable levels are analyzed. Low priority risks are reviewed at least annually, and the likelihood and the impact that they would have in case of changes in the internal and external factors are analyzed. It is possible that some risks drop out and for them not to be taken any further action. Therefore, essential are the constant monitoring and the regular review of the actions related to risk management.

Conclusion

Managing and reducing disaster risk is a moral and social responsibility of all management levels. On the basis of the evaluation of the risk, it is possible to determine the level of risk for any natural disaster, to estimate the probability of occurrence, and a map of the risk assessment. As mentioned above, proper identification and definition of the risks is a criterion for the good security situation and the minimization of the adverse effects of threats.

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References:

[1]. Five steps to risk assessment, HSE p.8
[2]. Georgiev V., Risk Management - textbook. Military Publishing House, 2005, 168p.
[3]. Georgiev Y., ‘’Risk Management in security’’, Sofia 2012, p. 226
[4]. Hristov H., Aspects of common security and defense policy of EU, Mattex 2014 Shumen, p.8
[5]. Kraev N., Analysis and quantitative risk assessment using the method CEL, p.9
[6]. Risk Management, Headquarters Department of the Army Washington, 2014, 76p.
[7]. National security of Bulgaria: Threats to 2020 – 2025, Sofia 2013, 56p.
[8]. Slatinski N., Introduction to risk management, Sofia 2010, p.13
[9]. Standard for risk management, FERMA 2005- ISO/IEC 27001:2005, Brussels, p.16
[10]. Standard for risk management, AIRMIC, ALARM, IRM, ISO/IEC, Guide 73:2002, London, p.17
[11]. Tudjarov H. ‘’Risk Management’’ ISMS, 2009, 158p.

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Original Contribution

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THE ISSUE OF FUNDAMENTALIZATION OF PROFESSIONAL TRAINING OF FUTURE ECONOMISTS

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ABSTRACT. *The issue of fundamentalization of professional training of future economists is considered in the article; the necessity of fundamentalization of professional training is grounded; aspects that are guaranteed by the fundamentalization are outlined; the main core of fundamentalization professional training of the future economists is highlighted – mathematization of knowledge through continuous mathematical training by integrating mathematical knowledge in professional disciplines; the essence of the proposed integrated approach is revealed.*

KEY WORDS: *fundamentalization, mathematization of knowledge, integration.*

In modern conditions, globalization processes are becoming stronger in all spheres of human life. The world is becoming interdependent and interrelated, so there is a need in the development, establishment and formation of a comprehensively developed personality. The strategic goal of the modern educational process is a student of great erudition who has holistic view of the world.

Achievement of the goal is possible only through the fundamentalization of education. The training of future economists is no exception.

The questions of fundamentalization of higher school education have been studied by such scientists as A.A. Adannikov, S.I. Arkhanhelskii, O.V. Balakhonov, S.A. Baliaeva, A. Hladun, O. Holubieva, S.U. Honcharenko, H.Ya. Dutka, L. Zorina, L.S. Yolhina, S.Ya. Kazantsev, M. Karlov, V.H. Kineliev, V.V. Kondratiev, A. Kochniev, E. Kniazieva, V.V. Kraievskii, S.V. Nosiriev, A.B. Olnieva, Z. Rieshetova, V. Sadovnichii, O.V. Sierheiev, A.I. Subetto, A.D. Sukhanov, N.F. Talyzina, A. Khutorskoi, V.D. Shadrikov, M.O. Chitalin, O. Filatova, V. Filippov and others.

Fundamentalization of higher professional education today is one of the priorities of the state educational policy in Ukraine.

In the Memorandum of UNESCO International Symposium it is written that the fundamental holistic natural-science and humanitarian education must play a key role in the formation of the personality and ensuring sustainable development of the society, it should be regarded as a separate and important branch of intellectual activity: it is essential to attract the attention of the world scientific and cultural community to the problem of creating an intellectual foundation for the modern system of education, in the development of scientific research in logic, methodology, philosophy, history, sociology and psychology of science, as well as to the development of advanced technologies of training in the field of fundamental education; the interests formation of a single educational space within the global community can be achieved through the development of common approaches to international educational standards, requirements for fundamental education. According to the conclusion of UNESCO, fundamental education is evaluated worldwide as one of the major factors of national security, the sustainable development of the country, provision of its high status in the world community. Fundamental education implies focus of its content on methodological, invariant elements of knowledge that contribute to the initiation, development and implementation of intellectual and creative potential of students [4, p.5].

All authors who have examined the issue of fundamentalization, are unanimous in saying that it is aimed at improving the quality of the educational process and at obtaining a high result − a highly qualified specialist that meets modern requirements (of a personality, the society, the production sphere and economy on the whole). In other words, many scientists think that fundamentalization is the category of the level and quality of education.

As for the other aspects and characteristics of fundamentalization, researches of the issue differ in their judgments. The more objectively and in more detail the matter is considered, the more different opinions, claims, judgments are actualized. At the same time, the emergence of new ideas and approaches makes it possible to analyse them and further unify the whole variety into a coherent theory or methodology, as well as to determine the boundaries of their possible application, and only then put into practice at higher education institutions.

S.V. Honcharenko believes that fundamentalization of education on the modern basis should act as the leading imperative of educational reforms. He believes that fundamentalization of education currently should be considered as a didactic principle, and indeed fundamental, as the new paradigm of education shows, is the personal knowledge domain [1].

For the first time the concept of fundamental education was formulated by W. von Humboldt in the early XIX century [2]. In this concept it was emphasized that the object of such education should be the fundamental knowledge that is today opened by the fundamental science at its cutting edge. W. von Humboldt was one of the first to express the essential idea of higher

education, which has become particularly important today – first and foremost, education must be scientific and creative, then it will generate in students a desire for constant creative search. Moreover, it was assumed that education must be directly integrated into the scientific research. It is this ideal of education that is realized in the best universities of the world for the last hundred years.

Higher school of the XIX century mostly followed the model of Humboldt. At the beginning of the XX century education in higher educational institutions was characterized by preparation of a single-discipline specialist. However, in the last decade the attention of scientists has returned to fundamentalization of professional training.

In the opinion of A.I.Subetto, fundamentalization in professional education guarantees:

– systemic level of cognition of reality, the ability to see and to explore the mechanisms of self-realization and self-development of phenomena and processes;

– the formation of the most significant, long-lasting knowledge underlying holistic perception of the modern world view;

– formation of a holistic encyclopaedic view of the modern world and a man's place in it;

– mastery of the basics of a single human culture in its natural-science and humanitarian areas;

– creation of a database of professional culture and professional skill [4, p. 11].

In the process of training in a higher educational establishment, future specialists in the sphere of economy study a quite large list of disciplines. The expansion of opportunities and deepening of scientific knowledge, observed in the curriculum, is accompanied by increasing of fragmentation and weakening of connections between disciplines. This in its turn may reduce the effectiveness of the cognitive process and the quality of training of students, including the ones of economic specialties. At the same time requirements for the level of training of future specialists, imposed by the state, rise.

American scientists have found a direct link between the level of mathematical training and quality of experts in the field of economy and finance.

Mathematical preparation becomes increasingly important for modern economists. Moreover, mathematics is not only basic (fundamental) for the study of special disciplines, but also the basis of scientific activity.

Therefore, we consider mathematization of knowledge the main core of fundamentalization of professional training of future economists.

We suggest conducting professional training of future economists on the basis of continuous mathematical training through the integration of mathematical knowledge in professional disciplines.

The essence of the proposed integrative approach is revealed in the following main provisions:

- implementation of intra- and inter-subject relationship;
- development of integrated courses;
- applied orientation;
- enlargement of didactic units;
- continuity in teaching mathematics;
- the systemic nature of knowledge in teaching mathematics.

One of the possible ways of integrating mathematics, information and communication technology and special subjects is described in detail in the article [5].

The principle of the integrative approach is focused on the formulation of goals and objectives of training, providing the formation of complex knowledge and skills and systemic thinking.

The integration creates conditions for convergence and interpenetration (association) of sciences, the creation of new industries and the emergence of new academic disciplines in higher educational institutions (e.g., econometrics, methods of managerial decision-making, optimization methods and models, etc.).

The integration is now becoming an integral part of the process of development of modern science, and therefore one of the fundamental ideas of modern methodology, pedagogy and psychology.

Integration allows avoiding discreteness in the acquisition of knowledge and skills, provides the possibility of developing conditions conducive to the formation of systemic, holistic scientific knowledge and practical skills.

The main objective of the integrative approach in the preparation of the future economists is the formation of readiness of an economic specialty graduates to the professional activity on the basis of unity and integrity of mathematical and professional knowledge.

Thus, fundamentalization of professional training of future economists suggest that the future expert in the field of economy in the process of training will receive the necessary fundamental basic knowledge (primarily the mathematical component), with the help of which a unified worldview scientific knowledge system will be formed.

References:

[1]. Honcharenko S.U. Fundamentalization of education as a didactic principle [Fundamentalisatsia osvity yak dydaktychnyi pryntsyp]. Sliakh osvity. – 2008. – № 1. – pp. 2–6.
[2]. Kineliov V.G. Education and civilization [Obrazovanije I tsyvilizatsyja] // The regional politics of the Russian Federation in the field of education. vol. IX. - Saranks, 1997. - pp. 376-392.
[3]. Memorandum of UNESCO International Symposium [Memorandum

mezhdunarodnoho simpoziuma UNESCO] // Higher education in Russia. – 1994. - №4. – pp.4-6.
[4]. Subetto A.I. Problems of fundamentalization and sources of the content of higher education: Facets of public policy [Probliemy fundamentalizatsyi I istochnikov formirovaniia soderhaniia vyssheho obrazovaniia: Hrani hosudarstvennoi politiki]. - Kostroma: Kostroma ped. un., 1995. - 332 p.
[5]. Tkach Yu.M. Some aspects of the integration of mathematics, information and communication technologies and professional disciplines [Okremi aspekty intehratsii matematyky, informatsiino-komunikatsiinykh tekhnolohii ta fakhovykh dystsyplin] // International collection of works “Didactics of mathematics: issues and researches” / editorial board: O.I.Skafa (sc. editor) and others; Donetsk National University; Institute of Pedagogics of the Academy of Pedagogical Sciences of Ukraine; National Pedagogical Dragomanov University. – Donetsk, 2014. – vol. 41. – pp.51-59.

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OPTIC SYSTEM FOR A SPECTROPHOTOMETER

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ABSTRACT: *The paper is about an optic system of a spectrophotometer for research of ozone in the atmosphere. The spectral operating range is in the near ultraviolet part of the optic specter - the absorption bands of Hartley and Huggins and the visible part - the absorption band of Chappuis.*

An optic system for a mirror-lens objective and optic system of an optic jack, consisting of mirror components is researched. A mathematical substantiation of the research is performed.

KEY WORDS: *Optic, Spectrophotometer, System.*

In this part of the spectrum is limited use of lens elements and thereby it is proceeds to the mirror and the mirror-lens and in these systems a major role in the formation of an image to the reflective surface is given [1,3]. These surfaces are characterized with the fact that chromatic aberrations are not imported [2,4].

To compensate for the spherical aberration of the mirror systems is studied afocal achromatic compensator located in the parallel beam. In this optical system, the lens can be expressed in two versions - when the compensator is located at a certain distance from the mirror and lens (Fig. 1) where the secondary mirror to part of the last surface of the compensator is applied (Fig. 2).

Proposed is the following sequence of calculation of baseline scenario of the first type of lens (Fig. 1) and as a particular case lens of second type (Fig. 2).

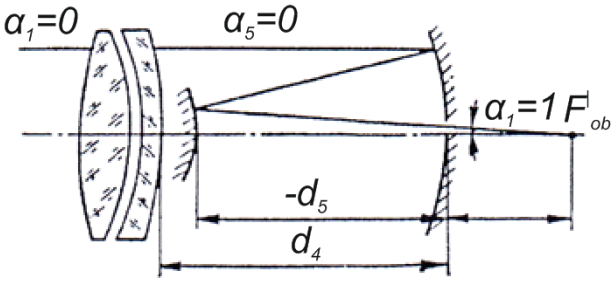

Fig. 1. Optical scheme of mirror objective lens with afocal achromatic compensator located a specific distance from the mirror lens

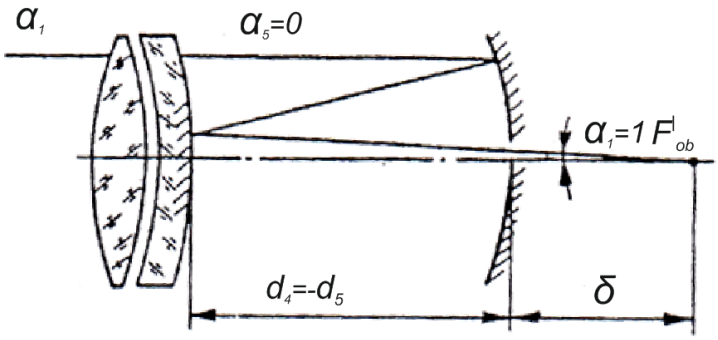

Fig. 2. Optical scheme of mirror objective lens with afocal achromatic compensator wherein the second mirror to the last surface of the lens is applied

In carrying out the calculations it is assumed that the compensator is infinitely thin (Fig. 3) from where:

$$(1) \qquad \begin{cases} d_1 = d_2 = d_3 = 0, \\ h_1 = h_2 = h_3 = h_4 = h_{ком}, \\ y_1 = y_2 = y_3 = y_4 = y_{ком}, \\ \beta_1 = \beta_5. \end{cases}$$

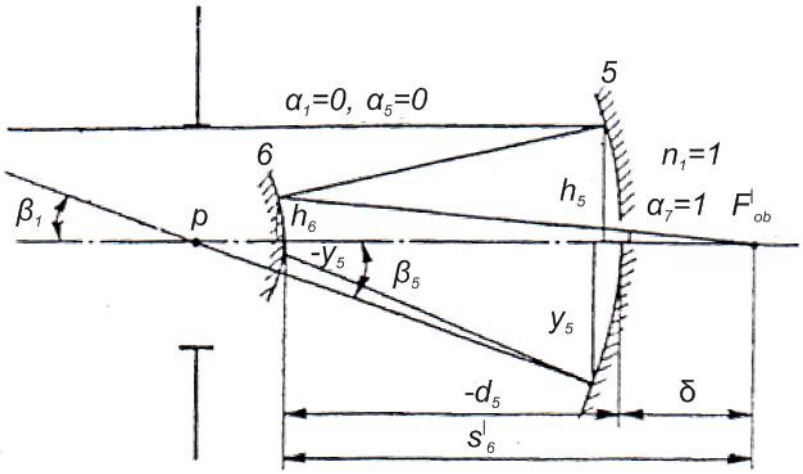

Fig. 3. Move the first and second paraxial ray in mirror objective lens with compensator located in parallel beam

For the system in the air:

(2) $$n_1 = n_3 = n_5 = n_7 = 1;\ n_6 = -1.$$

From the overall calculation of mirror part of the lens are determined the radii r_5 and r_6 of the mirrors and the distance between them d_5:

(3) $$\begin{cases} r_5 = \dfrac{2}{\alpha_6}; r_6 = \dfrac{2k}{1+\alpha_6}; \\ r_5 = \delta - k; \alpha_6 = \dfrac{1-k}{\delta - k}. \end{cases}$$

It is calculated the third order aberrations imported from the mirror part of the lens. In case that input aperture coincides with the top of the first surface of the compensator ($S_P = 0$), and accepted normalization of the first and second paraxial ray:

$\alpha_1 = 0$, $\alpha_5 = 0$, $\alpha_7 = 1$, $h_{ком} = h_{ком} = h_5 = f'_{об} = 1$, $y_{ком} = 0$ (S_p=0), $I = -1$, $\beta 1 = \beta 5 = +1$, the formulas for $S_{1огл}$ and $S_{2огл}$ [6] accept the type:

(4) $$\left.\begin{aligned} S_{1огл} &= \sum_{v=5}^{6} h_v P_v = P_5 + kP_6 \\ S_{2огл} &= \sum_{v=5}^{6} y_v P_v - I \sum_{v=5}^{6} W_v = y_5 P_5 + y_6 P_6 + w_5 + w_6, \end{aligned}\right\}$$

where:

(5) $$\left.\begin{aligned} P_5 &= -\frac{\alpha_6^3}{4} = -2\rho_5^3; \\ P_6 &= \frac{(1-\alpha_6^2)(1-\alpha_6)}{4} = \frac{(1-4\rho_5^2)(1-2\rho_5)}{4}; \\ W_5; \frac{\alpha_6^2}{2} &= 2\rho_5^2; W_6 = \frac{1-\alpha_6^2}{2} = \frac{1-4\rho_5^2}{2}, \end{aligned}\right\}$$

As y_5 and y_6 are heights of the second paraxial ray. They are determined by calculating move of the second paraxial ray (Fig. 3).

(6) $$y_5 = y_{ком} - d_4\beta_5.$$

$$y_5 = -d_4;$$

(7)
$$n_6\beta_6 - n_5\beta_5 = \frac{y_5(n_6 - n_5)}{r_5};$$

$$\beta_6 = \frac{n_5}{n_6}\beta_5 + \frac{y_5(n_6 - n_5)}{r_5 n_6} = -\frac{d_5 + d_4(1-k)}{d_5};$$

(8)
$$y_6 = y_5 - d_5\beta_6 = d_5 - d_4k.$$

Taking into account the (5÷8), then (4) it could be written in the type

(9)
$$S_{1огл} = -2\rho_5^3 + k\frac{(1-4\rho_5^2)(1-2\rho_5)}{4};$$

$$S_{2огл} = -d_4P_5 + (d_5 - d_4k)P_6 + 2\rho_5^2 + \frac{1-4\rho_5^2}{2}.$$

For determining constructive parameters of the compensator is necessary the calculation of the $S_{1об} = 0$ and $S_{2об} = 0$:

(10)
$$\begin{cases} S_{1об} = \sum\limits_{v=1}^{6} h_v P_v = \sum\limits_{v=1}^{4} h_v P_v + P_5 + kP_6 = 0; \\ S_{2об} = \sum\limits_{v=1}^{6} y_v P_v - I\sum\limits_{v=1}^{6} W_v = y_5P_5 + y_6P_6 + \sum\limits_{v=1}^{4} W_v + w_5 + w_6 = 0 \end{cases}.$$

Then

(11)
$$\begin{cases} S_{1ком} = \sum\limits_{v=1}^{4} h_v P_v = -S_{1огл}, P_{ком} = -S_{1огл}; \\ S_{2ком} = \sum\limits_{v=1}^{4} W_v = -S_{2огл}, W_{ком} = -S_{2огл}; \end{cases}$$

If $r_4 = r_6$ (fig. 2) the second mirror is applied to the last surface of the compensator, the angle of the first paraxial ray α_4 is determined considering its constructive conditions.

As $\alpha_5 = 0$ (because the compensator is afocal), then taking advantage of the formula for calculating the first paraxial ray

$n_5\alpha_5 - n_4\alpha_4 = \frac{h_4(n_5-n_4)}{r_4}$, laying $r_4 = r_{6огл}$. is obtained:

(12) $$\alpha_4 = \frac{n-1}{nr_{6огл}},$$

(13) $$\alpha_2 = \alpha_4 - \left(\frac{n-1}{n+1}\right)\frac{W_{ком}}{\alpha_3},$$

(14) $$(2n+1)\alpha_3^2 - \left[\frac{n^2-1}{n}\frac{P_{ком}}{W_{ком}} + 2(n+2)\alpha_4\right]\alpha_3 + (n+2)\left(\frac{n-1}{n+1}\right)W_{ком} = 0.$$

Denoting

$$2n+1=A,$$

$$\frac{n^2-1}{n}\frac{P_{ком}}{W_{ком}} + 2(n+2)\alpha_4 = B,$$

$$(n+2)\left(\frac{n-1}{n+1}\right)W_{ком} = C,$$

then equation (14) acquires the type

(15) $$A\alpha_3^2 - B\alpha_3 + C = 0.$$

When solving quadratic equation (15) is determined the angle α_3. The last (α_3) is placed in (13) and it calculates the value of the angle α_2. The known values of the angles of first paraxial ray the radii of infinitely thin lens of the compensator are defined by the formulas:

(16) $$r_v = \frac{n'_v - n_v}{n'_v\alpha'_v - n_v\alpha_v},$$

(17) $$r_4 = \frac{h_4(n_5-n_4)}{n_5\alpha_5 - n_4\alpha_4} = \frac{h_4(n-1)}{n\alpha_4},$$

(18) $$r_6 = \frac{h_6(n_7-n_6)}{n_7\alpha_7 - n_6\alpha_6} = \frac{2h_6}{1+\alpha_6},$$

whereupon

$$\begin{cases} h_1 = f'_{об}; h_2 = h_1 - d_1\alpha_2; \\ h_3 = h_2 - d_2\alpha_3;\ h_4 = h_3 - d_3\alpha_4; \\ h_5 = h_4;\ h_6 = h_4 - d_5\alpha_6, \end{cases} \tag{19}$$

are the heights of the first paraxial ray, and d_1, d_2 and d_3 are thicknesses of the lens of the compensator and air gap between the lenses.

Finally, can be made the following conclusions. A research of optical system for lens of spectrophotometer consisting of mirror objective lens and optical compensator with mirror components was conducted. Thanks to made research was derived formulas, allowing the determining the constructive parameters of lenses under which the afocal achromatic compensator is located at particular distance from the mirror lens and in case that the second mirror of the afocal achromatic compensator to the last surface of the lens is applied.

References:

[1] Apenko, M. I., Dubovik, A. S., Applied Optics, Science, 2002, 234 p.
[2] Klamath P.H., Buzzell M.A. Optic Technology, 2007 N 4, 178 p.
[3] Wormser E.S. Sensing the Invisible World. Applied Optics, 2004, Vol.6, p.174-181.
[4] Zhekov Zh., Optical systems for monitoring distance objects, Konstantin Preslavsky University Press, Shumen, 2007, 251 p.

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SPECTROPHOTOMETER WITH TWO CONCAVE DIFFRACTION LATTICES FOR INVESTIGATION OF THE ATMOSPHERIC OZONE IN THE STRIPS OF HARTLY-HUGGINS AND SHOPPUI

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ABSTRACT:
Optical scheme is proposed, designed for parallel work in the ultra-violet and the visible part of the optical spectrum, where the atmospheric ozone absorption strips exist. This increases the informativity, the accuracy and the precision of the achieved results and decreases the error in the measurements and the interpretation of the signals.

KEY WORDS: *Energy, optical systems, optical scheme of spectrophotometer.*

The object of consideration is optical scheme of spectrophotometer, designed for research the whole content of ozone in the strips of Hartly and Huggins in the ultraviolet part and also in the strips of Shoppui in the visible part of optical spectrum [1, 3, 5].

In the specified devices (in recent years) dispersing elements are concave diffraction gratings *G*, which are located along a circumference of Rowland with center in point *O*, connecting the points *G* and *N* and appearing as a radius of the curvature of the grating. By positioning of input slot of Rowland's circle, the spectral image of rays, entering into horizontal plane it is located by circle in point $S_\lambda^|$ - determines the position of the output slit, responsible for diffraction maximum.

Denoting:

(1) $$SG = r, \quad S_\lambda^| G = r_\lambda^|,$$

then

(2) $$r = \mathrm{R}.\cos\varphi, r_\lambda^{|} = R.cos\ \varphi_\lambda^{|},$$

where: R is a radius of the concave diffraction grating;

$\varphi\ and\ \varphi_\lambda^{|}$ are angles of incidence and diffraction, associated with the ratio [1].

(3) $$\sin\varphi + \sin\varphi_\lambda^{|} = \frac{m\lambda}{\sigma},$$

where: m is an order of diffraction;

σ - coefficient of the grating.

In recent time most of the scientists are using spectrophotometer in which schemes simultaneously are operating two diffraction gratings [2, 4] that possess different step with parallel planes of dispersion (Fig. 1).

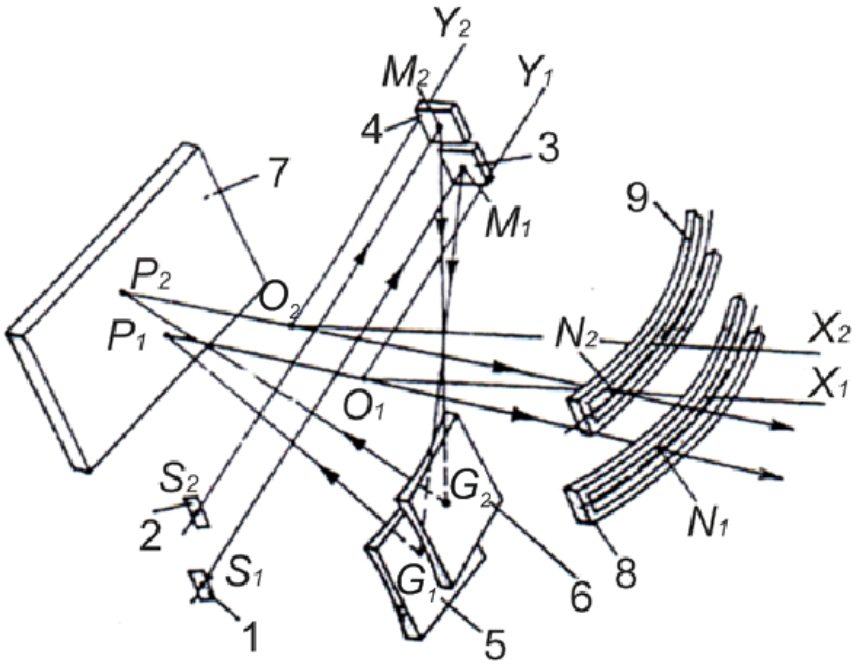

Fig. 1. Optical scheme of spectrophotometer

The lower and upper diffraction grating 5 and 6 form meridional images from the input slits 1 and 2, located under the circle of Rowland with centers respectively in the points O_1 and O_2. The arches 8 and 9 which are placed the output slits are part of Rowland's circle. For compactness and small-sized of the spectrophotometer are provided flat mirrors 3,4 and 7. The movement of the incoming rays $S_1M_1G_1$ and $S_2M_2G_2$ and diffracted to the normal $G_1P_1N_1$ and $G_2P_2N_2$ rays in the top and bottom optical scheme is presented. The points S_1 and S_2 denote the centers of the input slits; G_1 and G_2 are points of incidence of the main ray over the diffraction gratings 5 and 6; M_1 and M_2 - points of incidence of the main ray on the mirrors 3 and 4; P_1 and P_2 - points of incidence of

diffracted ray on the mirror 7; N_1 and N_2 - points of intersection with Rowland's circle and they denote the centers of the output slits. There is importing of two rectangular coordinate systems $O_1X_1Y_1$ and $O_2X_2Y_2$, located in the dispersion planes of the gratings. The axes O_1X_1 and O_2X_2 are parallel to the rays S_1M_1 and S_2M_2 (Fig. 1). The movement of main incidence and diffracted ray in one of the schemes (on the below scheme i = 1 or the upper scheme i = 2) on fig. 2 is illustrated. It was considered a vector in $\vec{A}_i = \overrightarrow{O_iG_i}$, vector $\vec{E}_i = \overrightarrow{O_iP_i}$ and his ort $\vec{e}_i$ $\vec{B}_i = \overrightarrow{G_iP_i}$ and his ort $\vec{b}_i$ vector. On fig. 2 is denoted with a the angle between mirror 7 - $\vec{c}_i$ and axis $O_iY_i\varphi_i$ - angle of incidence of the main ray on the diffraction φ_i =< $M_iG_iP_i$; δ_i =< $S_iM_iG_i$. grating, the angles α, φ_i and δ_i are positive.

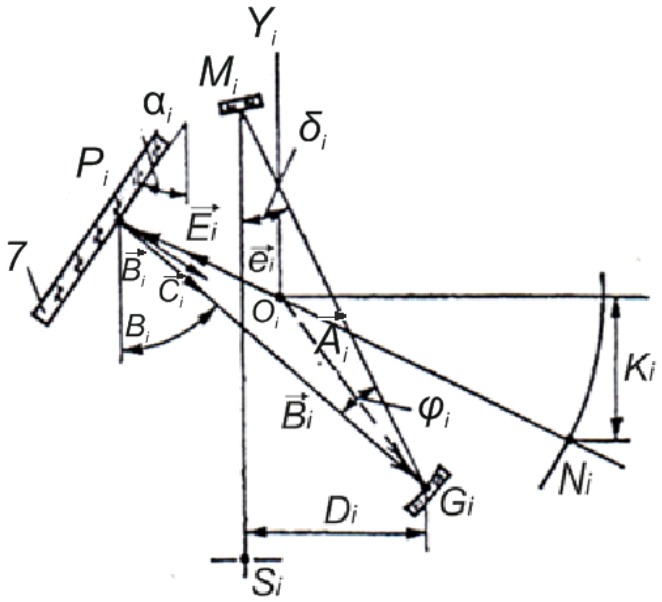

Fig. 2. The movement of the main ray in the lower and upper scheme of the spectrophotometer

For point V_i, located on the axis O_1X_1 will correspond coordinates $(V_i)_{x(j)}$ or $(V_i)_{y(j)}$, where i = 1,2 and j = 1,2. The meaning of index i illustrates to the bottom (i = 1) or to the top (i = 2) optic scheme the denoting point. Then:

(4) $$(O_2)_{x(1)} = \Delta x, \ (O_2)_{y(1)} = \Delta y.$$

It is obvious that:

(5) $$(V_i)_{x(1)} = (V_i)_{x(2)} + \Delta x, (V_i)_{y(1)} = (V_i)_{y(2)} + \Delta y.$$

It must be denote that:

(6) $$K_i = (N_i)_{y(1)}.$$

The value K_i by determined angel of incidence φ_i is defined by the position of the spectrum.

For the orts $\vec{e}_i$ and $\vec{c}_i$:

(7) $$\vec{e_i} = \begin{pmatrix} -\sqrt{1-\left(\frac{2K_i}{R}\right)} \\ -\frac{2K_i}{R} \end{pmatrix},$$

(8) $$\vec{c_i} = \begin{pmatrix} -\cos\alpha \\ -\sin\alpha \end{pmatrix}.$$

According to the law of reflection [3]:

(9) $$\vec{b_i} = \vec{e_i} - 2\vec{c_i}(\vec{e_i}\vec{c_i}).$$

Taking into account of (7) it is obtained:

(10) $$b_i = \begin{pmatrix} (\vec{e_i})_x - d_i cos\alpha \\ (\vec{e_i})_y - d_i sin\alpha \end{pmatrix},$$

where:

(11) $$d_i = 2\left[(\vec{e_i})_x cos\alpha - (\vec{e_i})_y - d_i sin\alpha\right].$$

At the center of the chosen coordinate system - point O_i lying on the vector B_i is in force the ratio:

(12) $$\vec{A_i} = \vec{Bi} + \vec{E_i},$$

(13) $$\vec{B_i} = \frac{R}{2} - \vec{E_i}$$

$$\vec{B_i} = B_i \vec{b_i},$$

$$\vec{E_i} = E_i \vec{e_i},$$

where: b_i and E_i are modules of the vectors $\vec{B_i}$ and $\vec{E_i}$.

Replacing (13) and (14) in (12), is obtained:

(15) $$(G_i)_{x(i)} = E_i\left[(\vec{e_i})_x - (\vec{b_i})_x\right] + \frac{R}{2}(\vec{b_i})_x ,$$
$$(G_i)y_{(i)} = E_i\left[(\vec{e_i})_x - (\vec{b_i})_y\right] + \frac{R}{2}(\vec{b_i})_y.$$

The ratio (14) is transformed into the type:

(16) $$E_i = \frac{2(G_i)_{x(i)} - R(\vec{b_i})_x}{2[(\vec{e_i})_x - (\vec{b_i})_x]} .$$

For determining the position of the mirror 7 (Fig. 2) it is necessary except to be known the coordinates of the point P_i. They are equals to:

(17) $(P_i)_{x(i)} = (\overrightarrow{e_i})_x E_i,\ (P_i)_{y(i)} = (\overrightarrow{e_i})_y E_i.$

On the plane of the mirror y are located points P_1 and P_2 (Fig. 1), therefore:

(18) $$\tan\alpha = \frac{(P_1)_{x(j)} - (P_2)_{x(j)}}{(P_1)_{y(j)} - (P_2)_{y(j)}}.$$

Replacing (17) in (18), by j =2 are obtained:

(19) $$\tan\alpha = \frac{(P_1)_{x(2)} - (P_2)_{y(2)} tg\alpha}{(\overrightarrow{e_2})_x - (\overrightarrow{e_2})_y tg\alpha},$$

where, according to (5):

(20) $(P_1)_{x(2)} = (P_1)_{x(1)} - \Delta x;\ (P_1)_{y(2)} = (P_1)_{y(1)} - \Delta y.$

The equation (20) together with (15) and (16) by i=2 allow to be determined the position of the grating of the upper scheme that provides a possibility for collaboration for the both optical systems.

The determining the position of the input slit. From fig. 2 follows:

(21) $(S_i)_{y(i)} = (M_i)_{y(i)} - S_i M_i.$

Taking into account (1) and (2):

(22) $S_i M_i = r_i - M_i G_i = R cos\varphi i - \frac{D_i}{sin\delta},$

where:

(23) $D_i = (G_i)_{x(j)} - (M_i)_{x(j)}.$

Except that:

(24) $(M_i)_{x(j)} = \frac{D_i}{tg\delta} + (G_i)_{y(j)}.$

Replacing (23), (24) in (22) for the position of the input process is obtained:

(25) $(S_i)_{y(j)} = \frac{D_i}{tg\alpha} + (G_i)_{y(j)} - R cos\varphi i - \frac{D_i}{sin\delta}.$

In conclusion it should be noted that the presented methods for calculating the optical scheme of spectrophotometer with two concave diffraction gratings that is designed to simultaneously research the atmospheric ozone in the strips of absorption of Hartley-Huggins (in the ultraviolet part of the optical spectrum)

and of Shoptoi (in the visible part), enables the variability of the output data, to analyze carefully sufficient quantity of optical schemes of spectrophotometers.

References:

[1] Minkov, I. M., Leontev V. G., Privalov V. E., Optics and spectroscopy, 1997, T. 62. pp. 1112.

[2] Svetnikov, A. G., Sh. A. Furmash, A. V. Tihonravov, S. A. Yanshish, Optics and spectrometers, 1998. T. 58. pp. 1078.

[3] Tang, J. F., Zheng Q. S. Appl. Opt. 1999. V 21, № 2, p. 272-276.

[4] Zhekov Zh., Optical systems for monitoring distance objects, Konstantin Preslavsky University Press, Shumen, 2007, 251 p.

[5] Zhekov Zh., Satellite ecological monitoring of the environment, Konstantin Preslavsky University Press, Shumen, 2014, 293 p.

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4G TRANSMISSION NETWORK PLANNING AND OPTIMIZATION

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ABSTRACT: *With the expansion of third-generation networks and attempts to increase speed technology of fourth generation networks is already underway, as true forecasts of experts in the mobile industry. The deployment of fourth generation networks are now a reality and is introduced by some mobile operators and suppliers. We can see many types of transmission networks in GSM standard, such as: star, chain, loop, etc. Unlike in 4G networks this will not happen, or at least in the beginning.*

KEYWORDS: *BER, Transmission Network Plannin, VCI, VPI,*

1. Introduction

Microwave link planning is similar to planning to that for GSM transmissions. However, with 4G data transmission via microwave links seems to generate a concern over the quality of the links. [1, .., 4]

2. Bit Error Rate

In GSM transmission, BER (bit error rate) of 10^{-3} is considered acceptable enough to achieve high quality services, but GSM transmission line carry more voice data traffic. New standards and systems for transmission required in 4G networks. The main difference in microwave transmission planning between GSM and 4G is lowering the BER. As the quality requirement for data transmission is considered BER of 10^{-6}. Recommended to be used standards such as ITU-T G.828, ITU-T 1.356 and ITU-T 1.357 to a high quality transmission. The recommended minimum values are 10^{-3} and 10^{-6} for PDH (Pesiochronous Digital Hierarch) and SDH (Synchronous Digital Hierarchy). Another aspect to be considered in performance to be easured using parameters such as "Cell Loss Ratio" (CLR). To reduce this value to a minimum, usually placed high target greater than 99.99%, however, that this may depend on an operator's requirementsgiven. [1, 3]

3. Topology

We can see many types of transmission networks in GSM standard, such as: star, chain, loop, etc. Unlike in 4G networks this will not happen, or at least in the beginning. There are two main reasons for this: the capacity requirements and delay. 4G network traffic consists of voice, CS data, PS data and common channels such as RACH, FACH, etc. If there are approximately seven users generating voice traffic and three users generating CS-64 and PS-64 (both 64 Kbps), then the total traffic generated by the base station (configuration 1 + 1 + 1) will be more than 50 Erl, of which only common channels represent more than 30 Erl. This increases the required capacity of almost 4 Els, while in the GSM transmission network, the configuration of 1 + 1 + 1 will have less than one El capacity. Thus, in many transmission lines (circuit round) are not preferred in 4G networks.

Delays cause preferably a star topology networks for 4G. For real-time traffic, especially data, the delay at the expense of quality. Long chains leading to more time for signal traffic to reach the RNC / SGSN, which will degrade the quality of the call. Star topology is used to reduce delays. [3, 4]

4. Detailed Planning

Detailed planning has four main aspects: 2Mb planning, network management planning, synchronization and parameters planning.

Parameter Planning

Planning parameters became a key part of the planning of the transmission network. Therefore, transmission planning in 4G networks is more complicated and difficult than transmission planning in a GSM network. To perform an accurate and successful planning is necessary to focus on traffic management.

Apart from virtual channels and virtual paths, there are also PVC (permanent virtual connection) and SVC (switched virtual connections). PVC is set up on a permanent basis. PVC connections are created by NMS or element managers and require SVC signaling protocol (UNI / NNI), to set up the connection. Signaling protocol used to set up virtual connections, allowing switching in the terminal station to an exchange and transfer of data. The principle of operation is the following: when a device wants to set up a connection with another, it sends a request by signaling request directly to the connected ATM switch, the packages contain the exact address of the final destination and all desired QoS parameters for the virtual connection. [3]

Signaling packet is assembled again by the switches and check whether contains the desired QoS parameters to create a virtual connection. It then creates VC incoming connection and sends the request of the interface as specified switching to the next ATM switch for further analysis until you reach your destination. Virtual connections are created all the way to the final destination, as each switch route explores signal packet and forwards it to the next switch.

If the switch is unable to provide the desired QoS, the request is rejected, and a message is sent back to the point of origin. If the endpoint can support the desired QoS, it responds with accept messages, and values of the VCI / VPI. Upon acceptance of the connections, traffic management ensure that each of the links are sticking to the agreed traffic. Defining the functions of traffic management:

- connection admission control (CAC);
- conformance monitoring and control;
- traffic parameters;
- queuing. [3]

Traffic Parameters

There are different types of service classes (CBR, UBR, etc.). Each of these is determined by a set of traffic parameters, which describes the characteristics of the source. These parameters are set to ensure the proper allocation of resources to achieve the guaranteed speed and to obtain the desired QoS throughout the network. The most common traffic parameters are as follows:

- peak cell rate (PCR) – defined as the maximum instantaneous transfer rate user. It can be calculated as the inverse of the minimum time interval between the response of the cells. If the time interval between two cells is 1 μs, therefore the PCR 1 / (1 x 10^{-6} s) = 10^{6} cells per second (CPS);
- sustainable cell rate (SCR) – arithmetic average, long-term transfer rate between the;
- maximum burst size (MBS) - the maximum number of cells which can be transmitted at a peak rate of the cell;
- minimum cell rate (MCR) – determined on the basis of the minimum rate required by the user. Transfer speed never falls below the minimum set by this value;
- cell-delay variation tolerance (CDVT) - this is a error margin which defines the acceptable variation in the time interval for transmission; i.e. it defines the upper limit of the variation in delay; [2, 3, 4]

Listed above parameters define the type of traffic, and called traffic descriptors. ATM forum has defined six parameters for determining the quality of traffic:

- cell loss ratio (CLR) - This is the ratio of the number of cells with loss (in transmission) to the total number of the transmitting cell. Losses may be due to an error, congestion or long delays;
- cell transfer delay (CTD) - When the cell transmitted from the source to the destination, the delay may be due to the propagation of the signal lines, etc. It can be defined as the average time of distribution from the cell to the destination, including the delays;

- cell delay variance (CDV) – Variations delay cell transfer. Measured by the parameter CDV, can be defined as the difference between the measure to transfer delay and the average delay on the same connection;

- cell error ratio (CER) - The ratio of the cell(s) transmitting an error to the total number of cells;

- severely errored cell block ratio (SECBR) - ratio of SES blocks (of cells) obtained from the total number of transmitted blocks;

- cell mis-insertion ratio (CMR) – errors in some headers, the cells can be transferred to the wrong destination. CMR is the total number of cells observed mistakenly handed over a period of time divided by the time interval duration. [2, 3, 4]

Connection Admission Control (CAC)

CAC algorithms determine whether a new connection can be accepted or rejected. A connection request is accepted only if sufficient resources are available and if the connection will not affect the existing QoS. Determinants new connection request are:

- traffic parameters for new connections and QoS requirements;
- existing traffic contracts and connection;
- allocated and unallocated bandwidth.

To maintain optimal network performance are a number of mechanisms in the cells; queuing, buffering, cell service and congestion control. Queuing happens when traffic from two cells arrive at the same time and goes to the same destination. When the cells with a higher transmission speed pass through a virtual connection with a lower traffic congestion is obtained. Buffering the cells occurs when two or more corresponding cells are designed for the same power at the same time

Configuration of network elements required specifying many parameters that are related with interfaces, ATM, IP, etc. Since ATM is used as a switching and multiplexing, each base station requires a device which can handle with these links. This device can be integrated with the base station or may be a separate element. [2, 3]

Interface Unit

The interface parameters of the devices are associated with the hardware interface and blocks PDH / SDH, which are used for transmitting ATM over SDH or PDH. The parameters of the hardware associated with the type of system being used, i.e. whether it is based on ETSI (E1) or ANSI-based (T1) and the like. PDH / SDH interface parameters are related to the configuration of the SDH or PDH terminals that are used. They also include some parameters for test except those needed to select these terminals. [3, 4]

5. Parameters of cross-connection

It includes parameters that are needed to identify and termination of virtual channels, virtual paths and their cross-links. It also includes parameters describing the type of the traffic that is generated by these virtual channels and paths.

Cross connection can be achieved at the physical level, level and VP level VC (In GSM transport networks, cross ties are carried out only on a physical level). Example of cross-connection is shown on fig.1.

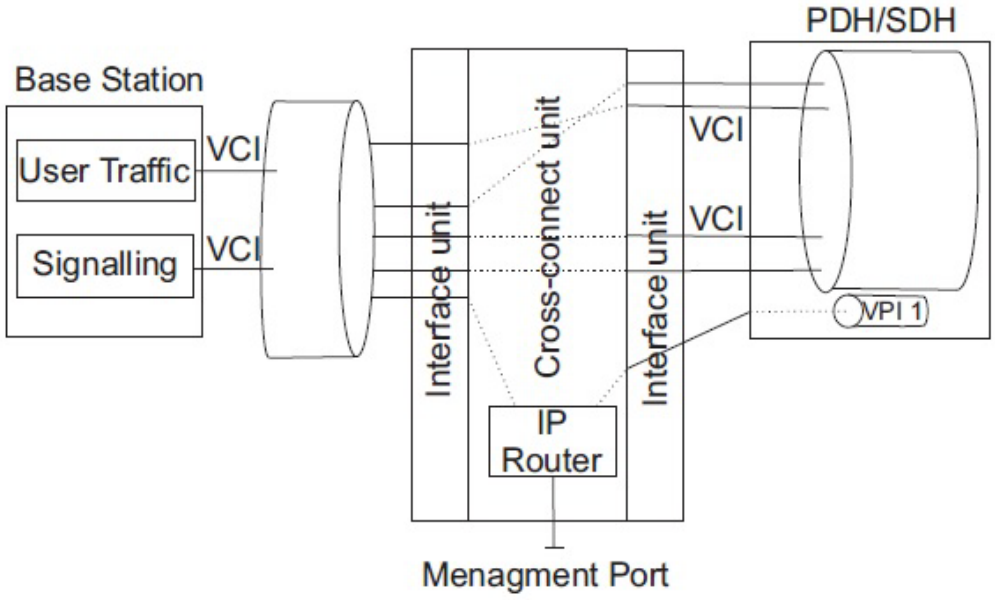

Fig. 1. An example of cross-connection

For a transfer planning should pay attention to:

- the types of traffic;
- the VP and VC connections;
- the number of VPs and VCs (i.e. VPIs and VCIs)
- VP and VC cross-connections
- physical, VP and VC connection parameters.

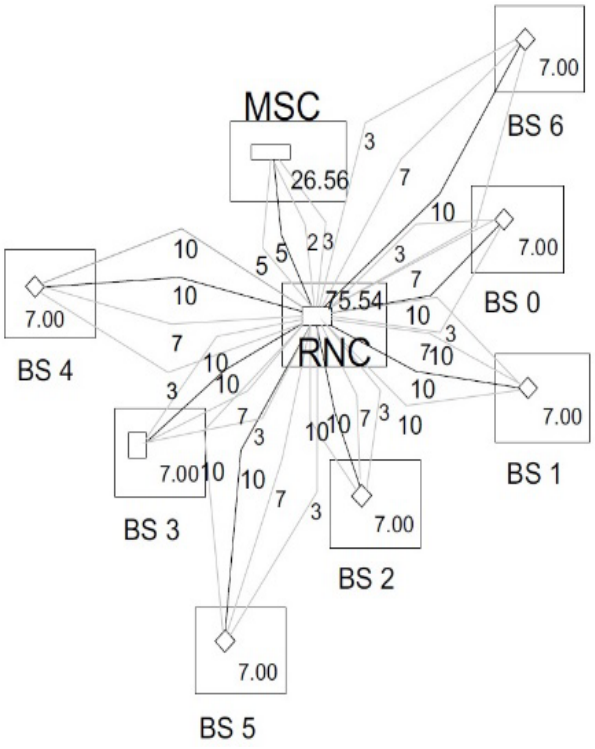

Fig. 2. Transmission line planning

All these aspects of Transmission line planning are complex, especially for large networks. During the rollout phase of the network, this process becomes even more complex. For this reason, using good planning tools. [3] Example of transmission line planning is shown on fig.2.

6. Transmission Network Optimization

In the process of transmission network optimization is basically the same as for GSM transmission, but there are two additional requirements: setting parameters and quality of service. The process begins with the definition of key performance indicators and the process of data collection followed by an analysis of their quality parameters and settings. Then final plans for optimization are made to meet the desired quality of service.

Optimization of the network is primarily aimed at increasing the capacity and quality, against the QoS requirements of the applications used by subscribers. In GSM networks have very few key performance indicators, mostly related to the quality of the microwave network. However, their number in 4G networks increases significantly with increasing key performance indicators. Data collection includes mainly existing data network, the configuration of the site, network topology, budgetary calculations, data entry, monitoring data (ie power

levels observed during the operation), and the implementation of key indicators . Data analysis consisted of an analysis of the capacity and quality analysis. [1, 2, 3, 4]

7. Capacity analysis

For transmission of GSM network capacity calculation and valuation is relatively simple. If the configuration of the site TRXs knowledge, it has the necessary capacity for connection can be calculated easily. However, analysis of the capacity of the 4G network is not as direct. We have seen that the calculation capacity depends on the type of traffic and thus can not be calculated directly from the number of TRXs or number of requests. Usually, when the capacity of the line is designed in the preliminary planning future needs are taken into account. In GSM optimization grid increase in traffic will lead to an increase in the number of TRXs or number of sites. Back in 4G network traffic increase could lead to an increase in the number of signal processors / application managers and / or TRXs base stations, as well as their expansion, which will increase the capacity of the link. Base station with a small number of users generate significant traffic. Increasing bandwidth will mean that the RNC capacity must be reviewed.

Thus, the capacity of the transmission network can be increased by:

- increasing the number of signal processors/application managers and/or TRXs;
- increasing the number of base station sites;
- increasing the number/capacity of RNCs.

Dimensioning plays a very important role in the whole process. The network is designed primarily based on factors such as the existing constraints, knowledge and equipment at the time of launch the actual network. Subsequently many factors and parameters are changing, so you need to reassess the sizing. General Data consist of actually achieved and collected data, such as topology, budget calculations for line analysis of interference capacities links, etc. Available data for the performance can also be saved for a longer period of time. The parameters of the radio network again divide the sized and optimized. All effects of optimization parameters can be applied to transmission networks. Thus subsequently connection between certain parameters and characteristics of the transmission network could be explored, which will allow the determination of such parameters that the implementation of optimization to provide the best QoS for the network. Once this is done, the optimized parameters are transferred back to network analysis, so as to cross-check whether they give the desired result for network operation. [1, 2, 3, 4]

8. Conclusion

1.Traffic loads, and the applications used, that affect the performance of an 3G transmission network more than than 4G transmission network;

2.The spectrum efficiency in an 4G transmission network is higher than in 3G transmission network, which is mainly because of the higher throughout and better link performance;

3.Though the performance measurements and subsequent results are usually based on data throughput, in real network optimisations both voice and data traffic performance have to be assessed.

References:

[1]. Tsonev, I. Data Transmission and Computer Communications Shumen, University Publishing, 2012.

[2]. Harri Holma, Antti Toskala. LTE for UMTS OFDMA and SC-FDMA Based Radio Access. 2009. p. 450

[3]. Ajay Mishra. Fundamentals of Cellular Network Planning and Optimisation 2004. p. 290

[4]. Moray Rumney. LTE and the Evolution to 4G Wireless. 2009. p. 457

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RADIO FREQUENCY REQUIREMENTS IN ACQISITION, DESIGN AND CONSTRUCTION PHASES OF SITES

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ABSTRACT: *The sets out the minimum requirements required by a designer to complete the design of a BTS site. This report is a guide and is not intended to fully cover all aspects of the design of all BTS site solutions.*

The report also sets out a number of basic requirements/guidelines for a construction to perform activities at a BTS site. The following section provides guidance on the various RF (Radio Frequency) elements of a base stations during the site selection, design and construction phases of sites

KEYWORDS: *Antenna positioning, Antenna types, Antenna feeders, BTS*

1. Introduction

Radio frequency requrements sets out the specifications and standard details to be utilised in the design of Base Transceiver Station (BTS) sites selection, design and construction of cellular network.

The sets out the minimum requirements required by a designer to complete the design of a BTS site. This report is a guide and is not intended to fully cover all aspects of the design of all BTS site solutions.

The report also sets out a number of basic requirements/guidelines for a construction to perform activities at a BTS site.

The following section provides guidance on the various RF (Radio Frequency) elements of a base stations during the site selection, design and construction phases of sites.

The RF elements of the base station covered within this section are:

- antenna positioning;
- antenna types;
- antenna feeders. [1, .., 4]

2. Antenna Positioning

Following information provides guidance on the positioning of antenna at base station locations. The listed below has been included to provide with an appreciation of the requirements that are involved when determining the site is suitable for use and then when locating the antenna for the site design. The antenna positions are critical.

Depending upon the antenna to be used and the configuration required many different locations on a rooftop can be used.

The preferable rooftop type installation from an RF point of view is wall mounted antenna as this solution provides the following advantages:

- block the antenna back lobe;
- limit the antenna side lobes;
- avoid the main lobe wide spreading backward when using mechanical tilt.

As with all potential sites equipment access and personnel safety need to be considered as part of the site design and therefore wall mounted antenna may not be the preferred solution for a particular site. [2, 3, 4]

The next preferred option is a flat roof building with sufficient space for the installation of individual poles (one per sector). If there is not sufficient space on the roof for poles or a guyed mast then wall mounted antennae positions should be considered. Irrespective of what antenna support system is finally chosen it must be able to provide:

- the specified antenna height (from ground level);
- the specified antenna base height from the roof;
- the specified azimuth;
- the absence of obstructions inside the main lobe angle plus 20° either side.

Height of the Antenna above the Roof

With regards to the positioning of antennae on a flat roof site, the ideal location is in immediate proximity to the edge of the roof. This will prevent vertical shadowing. In the cases when the antenna are not placed in this location, the influence of the roof and the structures situated on it should be taken into consideration to ensure that the antenna are mounted at a suitable height to nullify the affects of the rooftop.

In the case where there is an obstruction on the roof in front of the antenna then it should be taken into consideration when determining the maximum permissible value for “D”. The height of the obstruction located in front of the antenna should be deducted from “H” and the new value for “D” determined from Table 1 with this new “H” value. Antenna mounted and suitable is shown on fig.1.

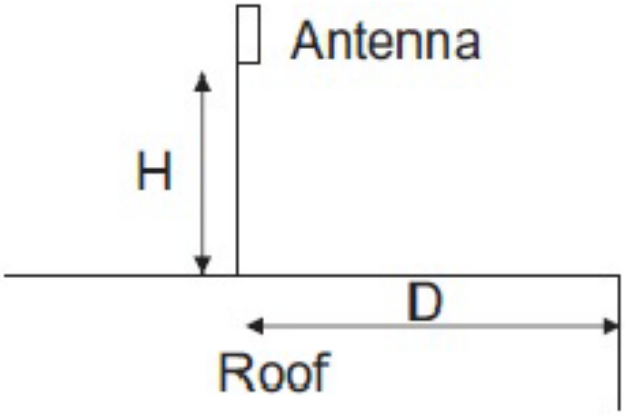

Fig. 1. Antenna mounted and suitable

Table 1

D(m)	1	2	3	4	5	6	7	8	9	10	15	20	25	30
H(m)	0.5	0.9	1.2	1.6	1.9	2.2	2.5	2.8	3.2	3.5	4.9	6.4	7.8	9.2

In the case where the antenna is vertically tilted (electrically or mechanically) the height “H” should be increased according to the specific case and this is to be coordinated with the Operator Radio Planning Department. [2, 3]

Distance between the Antennas

If there is more than one antenna installed at a site then it is necessary separation for diversity and isolation.

Controlled Case

Controlled cases refer to the installation of antennas within a operator system where all the antenna parameters are known. This is for the case where more than one antenna of the same azimuth is installed, i.e. a two-band sector or expansion of the capacity.

The values specified in Table 2 below are valid under the condition that the two antennae are positioned in one vertical plane. In all other cases additional coordination with the Operator Radio Planning Department is required.

In the event of assemblage of GSM-900 and GSM-1800 antennas one above the other (via vertical separation), the GSM-1800 antennas are recommended to be positioned above the GSM-900 antennas.

Table 2

Configuration	Minimum horizontal distance	Minimum vertical distance
900MHz←→900MHz/UMTS	1.00m	0.5m
900MHz←→1800MHz/UMTS	1.00m	0.5m
1800MHz←→1800MHz/UMTS	1.00m	0.5m

Minimum horizontal distance is centre to centre linimum vertical distance is edge to edge

Non-Controlled Case

Non-controlled cases refer to the positioning of antennas in close proximity of antennas of other operators. In this case it is necessary to provide a longer horizontal distance between antennas due to the fact that the parameters of the other operator antennas are not known.

There is also a risk that in the future the other operator may alter the azimuth of their antenna without notifying about this fact. Increased separation of the GSM-900 and GSM-1800 antennas is therefore necessary in order to minimize the influence of the inter-modulation products of the functioning of the two systems.

The recommended minimum distances between the antennas and those of other operators are to be as shown in Table 3.

In principle it is necessary to provide free of impedance space in close proximity zone of the antenna (min. 30m from the antenna). Due to the presence of better insulation between the antennas, it is recommended to perform vertical separation between the antennas, when this is viable. [2, 4]

Table 3

Configuration	Minimum horizontal distance	Minimum vertical distance
900MHz←→900MHz/UMTS	3.00m	0.5m
900MHz←→1800MHz/UMTS	2.00m	0.5m
1800MHz←→1800MHz/UMTS	3.00m	0.5m

In the event of assemblage of GSM-900 and GSM-1800 antennas one above the other (via vertical separation), the GSM-1800 antennae are recommended to be positioned above the GSM-900 antenna.

Antennae Installations on Vertical Walls and Metal Structures

In the case of antenna assemblies being located on vertical walls and/or metal structures there is a risk of deformation of the available horizontal beamwidth. With a view to reduce the impact of this effect it is recommended the angle between the direction of the antenna and the plane of the wall (metal structure) is not less than the sum of a half of the width of the horizontal beamwidth plus 20°. Antenna Installations as shown in fig. 2 and fig. 3.

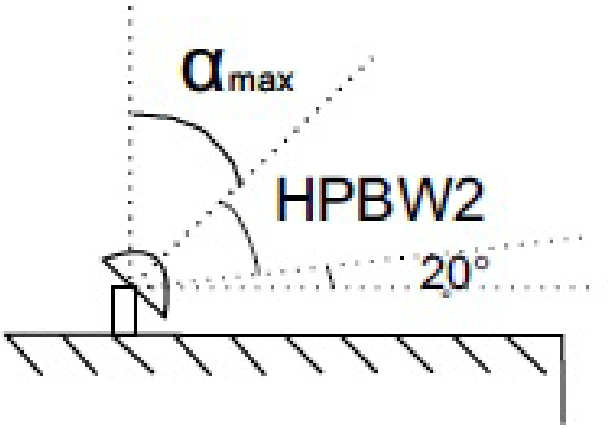

Fig. 2. Antenna Installations

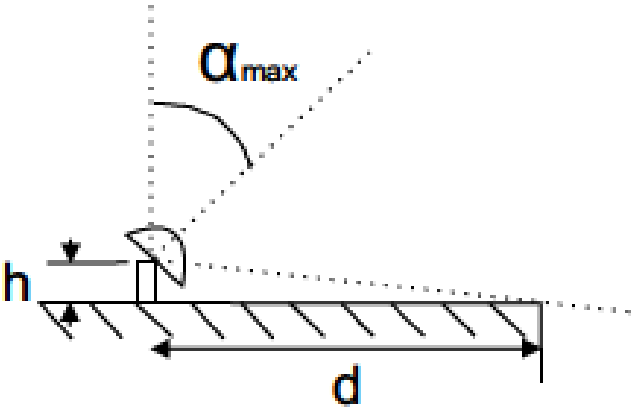

Fig. 3. Antenna Installations

If a second antenna is to be installed on the same plane then the physical distance between the two antennae and the potential loss of coverage due to shadowing from the adjacent antenna are to be considered when determining the locations. [2, 3, 4]

Feeder System Installation

There are currently several different feeder types installed within the network for the GSM 900 MHz frequency band.

Admissible Length of Antenna Feeders

The maximum admissible attenuation in the feeder system is a factor defining the maximum admissible length of the feeder. The cell site layout and feeder configuration must be designed to ensure that the feeder system does not exceed the maximum admissible attenuation. According to the various providers of GSM equipment the value of the maximum admissible attenuation in the feeder system is assumed within the limits of 3 to 4dB.

For GSM cell sites the maximum admissible attenuation will be 3dB. If the site cannot be designedwith a maximum attenuation less than 3dB then coordination with the Operator Radio Planning Department is mandatory before proceeding.

The minimum allowable bend radius of each coaxial cable type shall be as per the manufacturer installation standards. No coaxial cable runs shall be designed or installed with bends that do not meet the manufacturers recommended specification.

The table below recommends the feeder sizes and the ranges of feeder length where be deployed for GSM 900.

Table 4

Feeder Length (m)	Feeder Size
From 0 to 25m	½”
From 26 to 55m	7/8”
From 56 to 75m	5/4”

Feeder Label Requirements

Feeders shall also be clearly labeled at any entry/exit point along a feeder run where clear identification of individual feeders may be difficult.

On support structures the feeders shall be labeled at the top and bottom of the run at a point as near as possible to head height to facilitate easy reading of the markings without climbing the structure. Feeders shall be labeled even when covered by cable tray lid. Feeder label information shall be consistent throughout the feeder length. The labeling tag shall be fitted around the circumference of the feeder or along its length depending on feeder type, size and location. All jumpers installed shall also be clearly labeled at each end.

Tower Mounted Amplifiers (TMAs)

Tower Mounted Amplifiers (TMAs) can be used to improve the sensitivity of a base station therefore improving the overall cell coverage area and overcoming the effect of high feeder losses. The size and weight of any TMAs employed in the network need to be considered as space requirements and wind loading are important factors.

Power Splitters

Power splitters can be used to combine a number of antennas to increase the overall area covered or create a larger omni-directional antenna where each antenna can be down tilted individually to provide the required coverage.

3. Conclusion

1. Not only dimensioning, but rather an integrated network plan covering the full network, is required to ensure that the RF elements of network is working as expected;

2.Testing and auditing the RF elements of network in a systematic survey with the all system will provide a health check of the network capabilities as well as important findings affecting performance.

References:

[1]. Tsonev, I. Data Transmission and Computer Communications Shumen, University Publishing, 2012.

[2]. Harri Holma, Antti Toskala. LTE for UMTS OFDMA and SC-FDMA Based Radio Access. 2009. p. 450

[3]. Ajay Mishra. Fundamentals of Cellular Network Planning and Optimisation 2004. p. 290

[4]. Moray Rumney. LTE and the Evolution to 4G Wireless. 2009. p. 457

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A RESEARCH STUDY ON KONSTANTIN PRESLAVSKY 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/*

KEY WORDS: *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 form 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 6th 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 gradates 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 в 4 551 interviewed. The number of those who gave answers is 4 301 and is presented below:

Positions	*Number*
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**

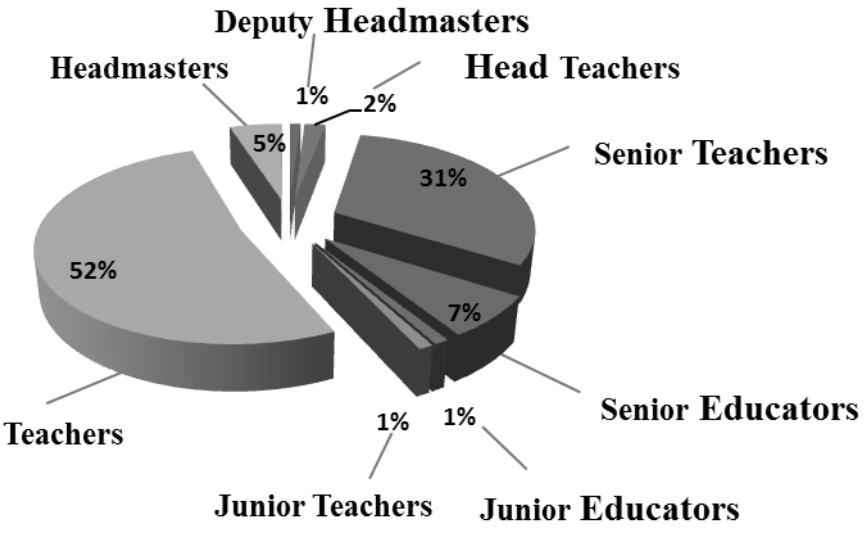

Fig.1. Distribution of positions of the interviewed who work in Secondary School Education System

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.

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