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ATMOSPHERIC POLLUTION BY INDUSTRY

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Abstract: *The paper concerns the problem of atmospheric pollution by industry on a local and regional scale. Particular basic pollution sources according to the law of cleanliness of atmospheric ozone are: sulphur dioxide, nitrogen dioxide, fine dust particles, nickel, arsenic, aromatic hydrocarbons, common dust, lead, cadmium, ozone benzene.*

ИЗСЛЕДВАНЕ НА ЗАМЪРСЯВАНЕТО НА АТМОСФЕРАТА ОТ ПРОМИШЛЕНОСТТА

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Резюме: *В доклада е разгледан въпроса по замърсяване на атмосферата от промишлеността в локален и регионален мащаб. Обособени са основни източници на замърсяване на атмосферата по закона за чистота на атмосферния въздух: серен диоксид, азотен диоксид, фини прахови частици, никел, арсен, ароматни въглеводороди, общ прах, олово, кадмий, озон бензен.*

Atmospheric pollution and the change of its quality content is a global problem which is mainly due to the excessive concentration of harmful emissions in the air (Zhekov, 2008).

Atmospheric pollution is natural and anthropogenic (Mardirossian, 1995).
The natural pollution is extraterrestrial (space dust) and terrestrial (continental – weathering, from volcano eruptions, plants, animals, as well as from the sea).

Anthropogenic pollution comes from the human activities and basically from the production processes (Stoyanov, 2009). They are the generators of the air polluters. First, it is necessary to specify the process of air pollution in the production environment and after that their emission and distribution in the air of the natural environment (Mardirossian, 2003).
The production sources can be:

- Organized, i.e. when the polluters are emitted from technical devices such as ventilation systems, chimneys, etc.
- Unorganized, i.e. when the polluters are emitted from gaps in the production buildings and production activities which are performed in the open environment or other similar situations.

The emissions can be in the normal functioning situations or they can be in accidental situations (accidental emissions). Usually the difference is in the intensity of the emissions of harmful substances and combinations.
The basic polluters of the atmosphere can be divided into the following groups:
Suspended particles. This group includes:

- Fine dust with particle diameter smaller than 100 μm;
- Coarse dust with particle diameter bigger than 100 μm;
- Smoke – 0,001 – 1 μm;
- Fog – 0,01 – 10 μm.

They are the largest percentage of the polluters. Suspended particles is a term which is used to describe the particles that hover in the air – solid or liquid, with bigger size than the molecules (d>0,0002 μm) but smaller than 500 μm. Within this size range, the particles can live in the air from a few seconds to a few months. The behavior of the particles smaller than 0,1 μm is determined a lot by the Brownian motion which is developed as a result of the collision of the separate molecules.

The particles with a size between 0,1 and 1 μm in a still atmosphere have a speed of precipitation which is less than the wind speed. With sizes bigger than 1 μm, the precipitation is noticeable but still small. For the particles with sizes around 20 μm, the precipitation speed is different. Such particles are precipitated in the atmosphere by means of the gravity or by means of other inertia forces.
the suspended particles alone or in combination with other polluters are a serious threat for people's health. They go into the human body mainly through the aspiratory system. It is found that about 50% of the particles with sizes from 0,01 to 0,1 μm penetrate into the lungs and precipitate.

The suspended particles can cause a toxic effect by the following ways:

1. The particle can be toxic because of its chemical and/or physical properties;
2. The particle can be an obstacle for one or more processes which are normally purified by breathing;
3. The particle can be a carrier of an absorbed toxic substance.

The effect of the powder aerosols depends on their chemical and physical properties, mass, form, density of the particles, hygroscopic capacity and solubility, pH, electric charge, etc.

The prolonged inhaling of high concentrations of powder aerosols leads to powder induced illnesses. When they go into the lungs, the dust aerosols cause inflammation, cancerogenous changes, allergies, fibrogenic reaction, toxic damages, etc.
Dust aerosols are divided into:

- dusts, abundant in free (uncombined) silicon dioxide. They cause silicosis;
- dusts, abundant in combined silicon dioxide. Their prolonged inhaling causes silicosis. Such are asbestosis (from absest dust), kaolinosis (from kaolin dust), talcosis (from talc), etc.
- dusts which do not contain silicon dioxide. They can be:

a) fibrosis dusts when inhaled cause illnesses called pneumoconiosis. they are named after the basic chemical substance that they contain : alluminosis, baratosis, manganism, etc.
b) non-fibrosis dusts which cause dust pneumonia when inhaled for a long time.

Toxic dusts cause toxic dust pneumoscleroses and toxic dust bronchopneumopathia. These are radiation, chrome, nitrophenol pneumosclerosis. The toxic pneumopathia are induced by the dust aerosols from tungsten, zirconium, titanium, molybdenum, etc.
Sulphur dioxide

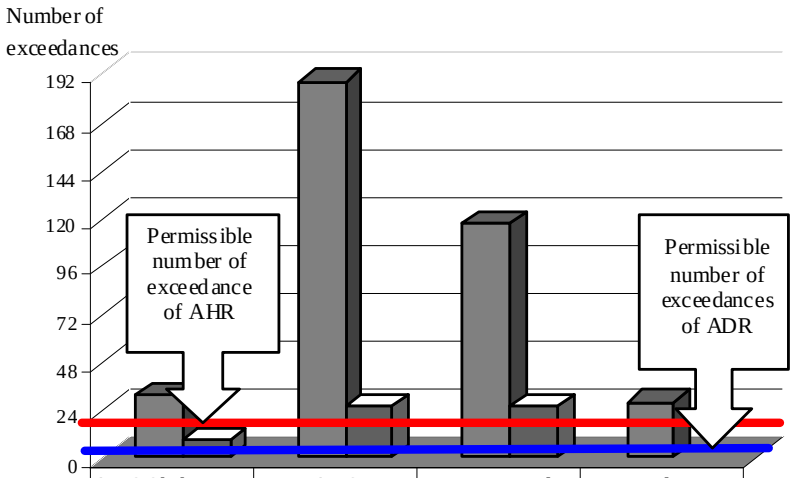
The maximum average concentrations of sulphur dioxide per hour are measured in Galabovo, Kardjali, Dimitrovgrad and Pernik. During the year, the average hourly rates and average daily rates for sulphur dioxide were exceeded in two Regions for Estimation and Management of the Atmosphere Quality (Southwestern and South/Trakian);
The basic sources of sulphur dioxide in South Region for Estimation and Management of the Atmosphere Quality are the three Thermal Power Stations in the region of energy complex Maritza Iztok and TPS Maritza 3 for the territory of the region of Dimitrovgrad and for the Southwestern Region for Estimation and Management of the Atmosphere Quality: Lead and Zinc Complex Kardjali and TPS Republika. An additional pollution are the emissions from the solid fuel which is used for heating ;

There were no registered exeedings of the rates for sulphur dioxide in the rest of the 4 Region for Estimation and Management of the Atmosphere Quality in Bulgaria in 2007, i.e. the registered number of exceedance of the rates is in the norm or there are none.

The average hourly rate of sulphur dioxide is considered exceedance in the monitoring stations in which there are more than 24 average hourly rates over 350 μg/m^3. The average daily rate of sulphur dioxide is considered exceedance in the monitoring stations in which there are more than 3 average daily rates over 125 μg/m^3 throughout a year.

During the year, the average hourly rates and average daily rates for sulphur dioxide were exceeded in two Regions for Estimation and Management of the Atmosphere Quality (Southwestern

and South/Thracian) because the number of the exceedance of the corresponding maximum rates for average hourly rates and average daily rates. There was no exceedance in the rest 4 Regions for Estimation and Management of the Atmosphere Quality.

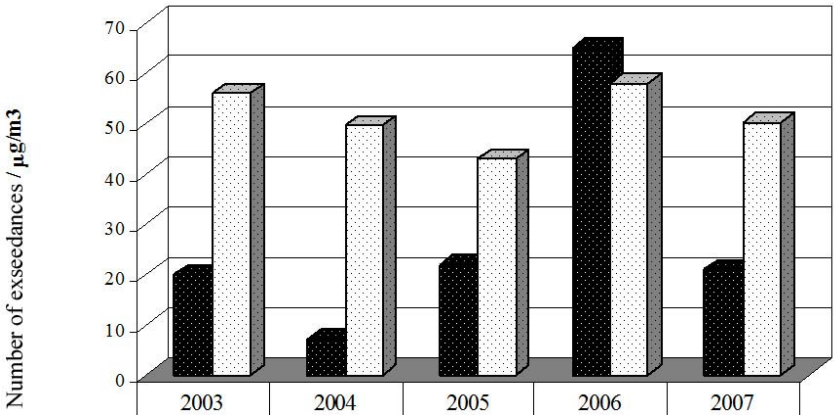


	AMS Shahtyor South western REMAQ	AMS "Galabovo" - South REMAQ	Dimitrovgrad AMS "Rakovski" South	Karjali "KOS" - Southwestern
Exceedances of the AHR	32	189	117	28
Exceedances of the ADR	9	26	26	

Fig. 1. Number of exceedances for sulphur dioxide

Nitrogen dioxide

During the year, the average hourly rate and the average daily rate for nitrogen dioxide were exceeded only in Sofia and the main source is the vehicles' emissions. In the rest of the Regions for Estimation and Management of the Atmosphere Quality in the country's territory, there is no exceedance of the rates of nitrogen dioxide in the atmosphere, i.e. the registered number of exceedance is in the permissible norm or there are none.



	2003	2004	2005	2006	2007
Number of exseedances 200m kg/m3	20	7	22	65	21
Average yearly concentration	56	50	43	58	50

Fig. 2. Registered exccedings of the rates of nitrogen dioxide in AIS « Orlov most » for the period 2003 – 2007

Fine dust particles (FDP_{10})

The pollution with fine dust particles continues to be a major problem for the quality of the atmosphere in every Region for Estimation and Management of the Atmosphere Quality. During the year, an exceedance of average daily rates and average yearly rates for (FDP_{10}) was registered in every Region for Estimation and Management of the Atmosphere Quality.

The highest concentrations for the country were measured in the town of Pernik, situated in the Southwestern Region for Estimation and Management of the Atmosphere Quality.

The sources of the registered pollution are the industrial, public and transportation activities on the territory of the corresponding municipalities, as well as the polluted roads which are poorly maintained.

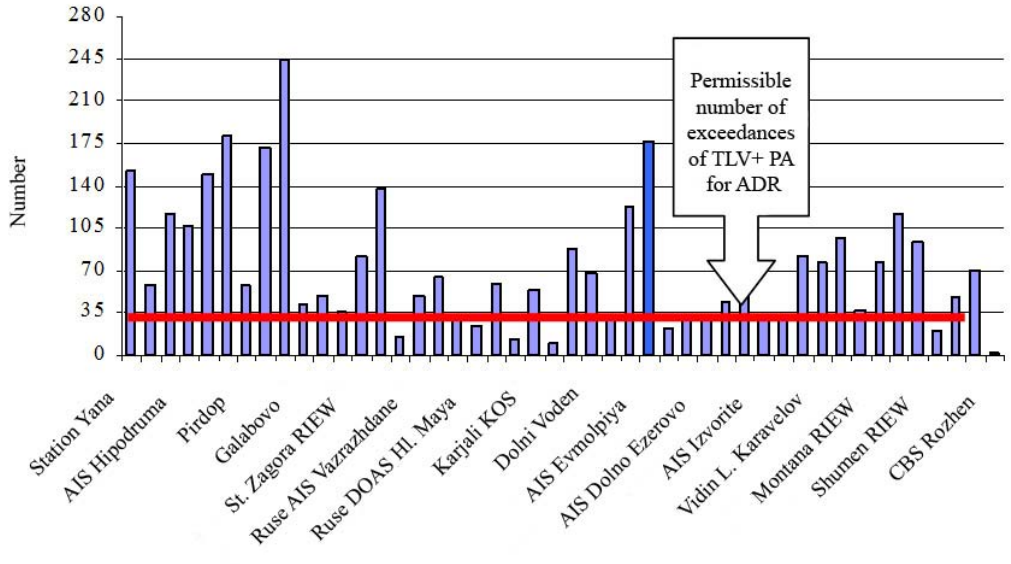


Fig. 3. Permissible number of exceedances of TLV+ PA for Fine dust particles (FDP_{10})

General dust

During 2007, there was no exceedance of the quantity of general dust. The highest average daily concentrations were measured in the towns Gorna Oryahovitza, Pernik, Veliko Tarnovo, Shumen, Varna and Sofia.

Lead

In comparison with the previous years, the tendency of decreasing the average yearly concentrations of lead aerosols in the atmosphere continues all around the country.

In 2007, the average yearly rates were exceeded only in Southwestern Region for Estimation and Management of the Atmosphere Quality and the source was the Lead and Zinc Complex in Kardzhali. After 2003, there is a tendency in the town of Kardzhali to increase the quantity of lead in the air.

Ozone

In 2007, the exceedance of the threshold value for the information of the public was registered in Sofia, Plovdiv, Bourgas and Southwestern Region for Estimation and Management of the Atmosphere Quality (180 μg/m^3).

There was no the exceedance of the threshold value for the warning of the public during the year (240 μg/m^3).

In every Region for Estimation and Management of the Atmosphere Quality, there was an exceedance of the threshold value for the protection of human health.

Carbon oxide

An exceedane of the rate for carbon oxide in the atmosphere (10 mg/m^3) is registered only in the Southwestern Region for Estimation and Management of the Atmosphere Quality. The major source is transportation.

Benzene

There was no exceedance of the threshold value for benzene for the protection of human health (5 μg/m^3) during the year and it should be kept after 01.01.2010.

Cadmium

The average yearly rate for cadmium is exceeded in Sofia, Plovdiv and Southwestern Region for Estimation and Management of the Atmosphere Quality.

The source of the pollution with cadmium in Pirdop, Kardzhali, Assenovgrad and Dolni Volen are the emissions from the non-ferrous metallurgy.

Nickel

In 2007 there was no registered exceedance of the average yearly rates for nickel in the atmosphere, which should be reached about 31.12.2012.

Arsen

In 2007 there was no registered exceedance of the average yearly rates for arsen in the atmosphere, which should be reached about 31.12.2012.

Aromatic hydrocarbons

An exceedance of the rate for aromatic hydrocarbons in the atmosphere is registered in Sofia, Plovdiv, North, Southwestern and South Regions for Estimation and Management of the Atmosphere Quality. The major source is transportation.
The major sources are the burning of different types of fuel, including by the public sector.

It can be concluded that the industrial air pollution in Bulgaria is controlled continuously and measures are taken all the time to decrease the emissions from industrial gas polluters. Basic atmospheric polluters are examined according to the Air Pollution Law: sulphur dioxide, nitrogen dioxide, fine dust particles, nickel, arsenic, aromatic hydrocarbon, general dust, lead, ozone, benzene, cadmium, etc. and this is done on a local and regional scale.

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