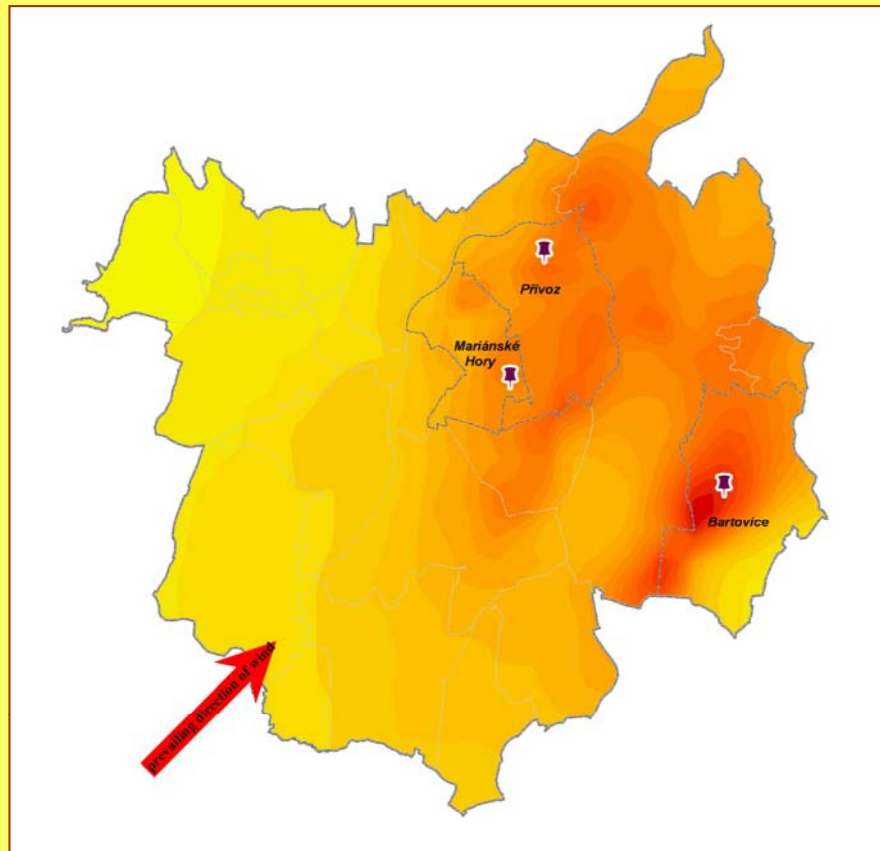




# CORRELATIONS BETWEEN MUTAGENIC POTENTIAL AND MEASURED POLLUTANTS IN OSTRAVIAN URBAN AIR (YEAR 2006)

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Map of Ostrava city with prevailing wind direction, sampled sites, and estimated index of air quality /from yellow (the health friendly) to red colors (serious health risk) by authors Kotlík (National Institute of Public Health, Praha) Michalík, Polaufová, Tomášková (Institute of Public Health, Ostrava), Czech Republic

## Introduction

Genetic toxicology testing is capable of finding substances (or mixtures of these) that can damage DNA. These processes could result in the initiation and progression of cancer. Ostrava region is one of the most polluted regions in the Czech Republic. Air quality is frequently evaluated by comparison of concentration of contaminant with its legislative limit. The real environmental air is a complex mixture of many contaminants acting simultaneously. The interactions among all of them are complicated not only on the chemical level. Resulting biological (genotoxic/ mutagenic) effect is dependent on an ability of live organism to react to all together acting components of the complex mixture on the biological level (the real cells with the real genetic material). The most widely used test to identify biological (mutagenic) effect of chemical or a complex mixture is Salmonella (Ames) test.

The aim of our study has been determining mutagenic potentials of sampled air and levels of selected pollutants during one year, based of which possible correlations between biological (mutagenic) effect of the real air and concentration of its components relevant to the genotoxic (mutagenic, carcinogenic) activity could be evaluated.

## Materials and methods

Air sampling (24 hours) has been performed at three industrial sites of the city (Přivoz, Mar. Hory, Bartovice - coking plant, chemical works, iron and steel industry, vehicle emission), four times a month during one year. (See the map of Ostrava city.)

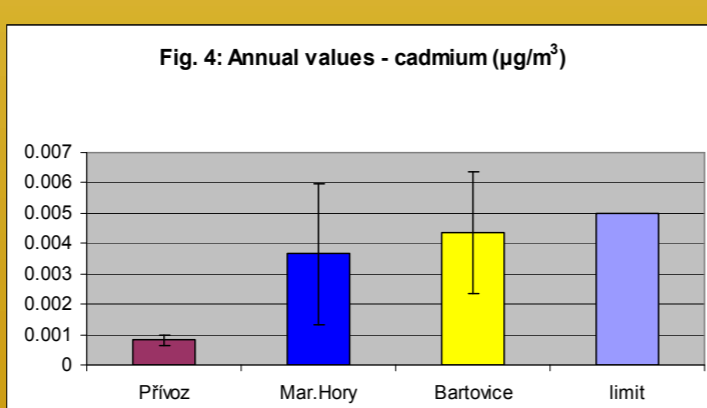
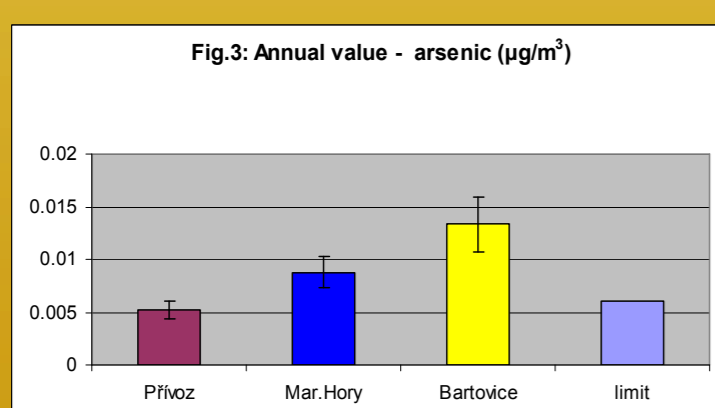
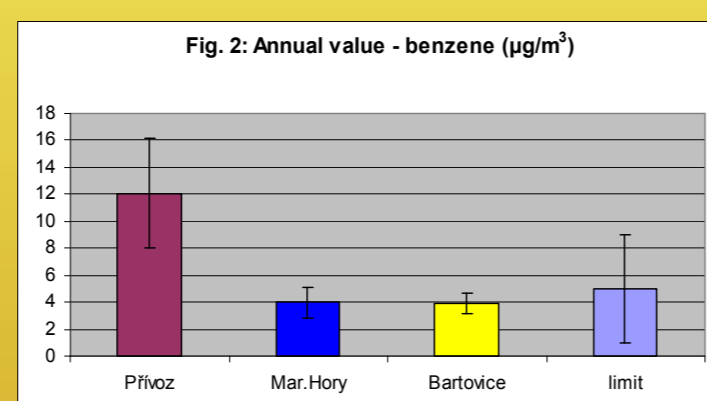
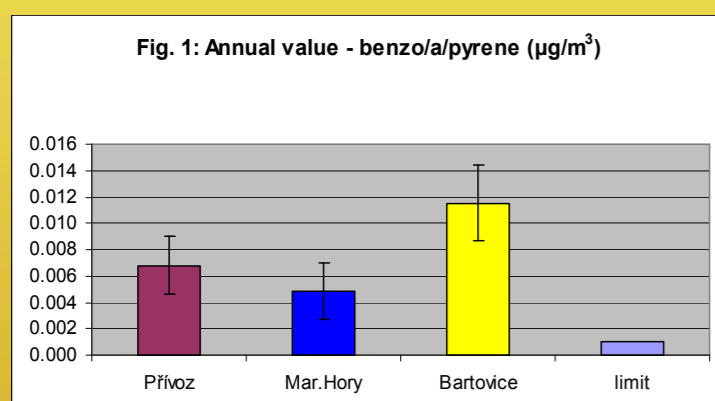
Chemical analyses of selected carcinogenic and mutagenic substances have been carried out: benzene, trichlorethene, styrene, toluene – gas chromatography with FID detector; arsenic, nickel, cadmium, chromium – X-ray spectrometry; eight polycyclic aromatic hydrocarbons (PAHs) including benzo(a)pyrene (B/a/P) – HPLC with fluorescence detection. Monthly means of individual pollutants (to find correlations with mutagenic potentials) and their annual means (to compare them with residential annual limits) have been calculated.

Concurrently pooled air samples from every site have been tested using the standard plate-incorporation Ames test (Salmonella typhimurium TA 98) monthly.

### Statistical methods

Statistical evaluation of mutagenic potentials using the Genetox Manager v. 2.21 program and the statistical evaluation of pollutant concentrations using ANOVA has been carried out. Associations between monitored factors have been analyzed by correlation and regression analyses.

## Annual values of pollutants



## Results and discussion

### 1. Pollutant levels

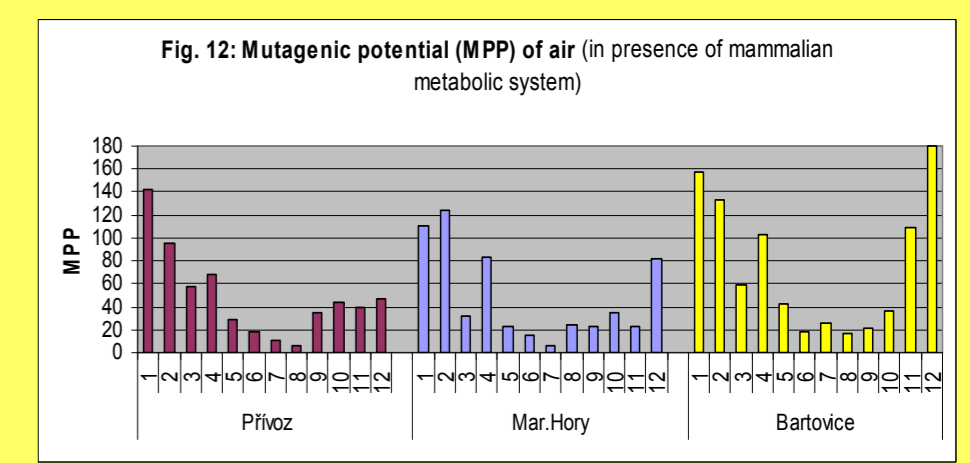
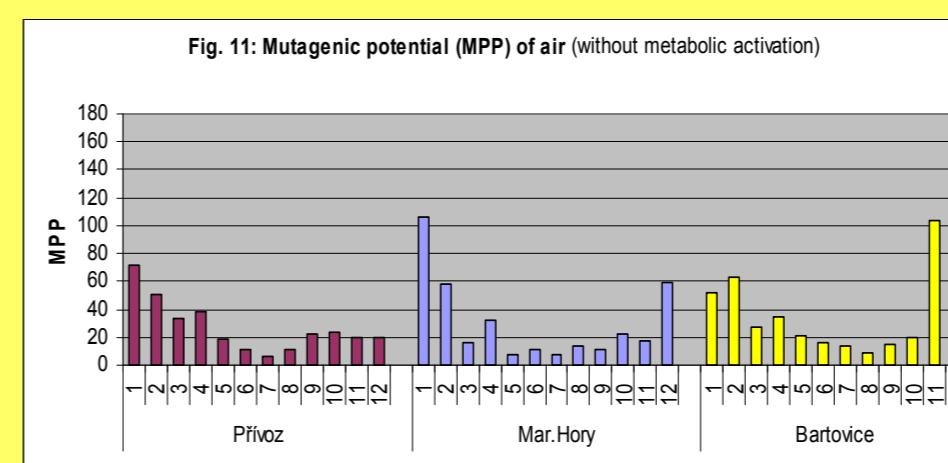
1.1. Annual values of pollutants for which air limit is set (Fig.1 – 4): B/a/P concentration exceeds the limit at all monitored sites (Fig. 1), annual arsenic value is in within the limit at one site while above it at two sites (Mar. Hory, Bartovice)(Fig. 3); the benzene exceeds the limit at one site only (Přivoz) (Fig. 2).

### 1.2. Monthly levels

In contrast with the monthly levels of volatile compounds PAHs' and metals' monthly levels display season-related differences (Figures 5 – 10).

### 2. Mutagenic activity of air

Mutagenic potentials (per volume of air) of monitored air samples (Fig. 11,12) have been found higher during the winter period in comparison with summer period at all sites. Levels of indirectly acting substances (for example PAHs – Fig. 12) have been observed higher than those for directly acting ones (Fig. 11).



### 3. Correlations between biological effect and presence of pollutants

Close correlations have been noted at all sites between mutagenic potentials of the air (Fig. 12) and presence of B/a/P (Fig. 5) and all measured PAHs (Fig. 6) (Přivoz  $r_{B/a/P} = r_{PAU} = 0.92$ ; Mar. Hory  $r_{B/a/P} = 0.81$ ;  $r_{PAU} = 0.78$ ; Bartovice  $r_{B/a/P} = 0.67$ ;  $r_{PAU} = 0.65$ ). The weakly correlation has been found between the levels of air mutagenic activity and concentration of arsenic (only Přivoz -  $r = 0.63$  - where the arsenic annual value have been the lowest). Furthermore, correlation between biological effect and the presence of volatile compounds - styrene, trichlorethene ( $r_{styrene, trichlorethene} = 0.71$ ) has been evident in one site (Mar. Hory).

## Conclusion

Our study confirms that interactions among components of the complex mixture with a number of potentially genotoxic substances are complicated. Taking into account mutagenic potency of Ostravian air, however, the major determined contribution seems to occur due to PAHs action.

## Monthly levels of pollutants

