ENVIRONMENTAL HEALTH MONITORING SYSTEM

Summary report 2023

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1. INTRODUCTION

The Environmental Health Monitoring System is a comprehensive system of regularly conducted collection of exposure and health data, and assessment of risks and effects on public health. The National Institute of Public Health (NIPH) provides information to public health authorities and state administration, including relevant governmental administration. Monitoring outputs are sent to European information networks and databases, and fulfils international conventions as well as European Union requirements; it is implemented through Resolution 369/1991 of the Government of the Czech Republic and its individual subsystems have been active since 1994. Monitoring is an activity of the healthcare sector which has been enshrined in Act 258/2000 Coll., as amended, and is constituent part of the Health 2030 Strategic Framework. The annual monitoring report for 2023 provides information from following sub-projects:

- **Health effects and risks of air pollution**

Air quality is described in urban and rural environments subjected to varying load, particularly in the case of pollution caused by aerosol particles, nitrogen dioxide, and polycyclic aromatic hydrocarbons. It shows long-term air pollution trends in common urban residential locations and residential locations with industrial or traffic load. The estimate of health effects and risks from airborne pollution was expanded this year to include the effects of ozone.

- **Health effects and risks of drinking and recreational water pollution**

This report provides a standard set of data on possible health effects from exposure to monitored substances, including pesticides, in drinking water from public water supply systems in the Czech Republic. Included is an overall assessment of recreational water quality in the 2023 season.

- **Dietary exposure**

The text presents evaluation of the biennial period 2022/2023 as regards intake of contaminants from the entire food consumption basket, showing long-term trends and comparing detected population toxic chemicals intake against exposure limits.

- **Human biomonitoring**

The NIPH Prague has been monitoring chemicals with hormone-disrupting effects since the launch of the Monitoring System in 1994. The next text will address the question of what we know about the burden of the Czech population from the collected data on the content of endocrine disruptors in blood, urine and breast milk.

- **Population health surveys**

This year, we describe the method and results of a screening survey in elementary schools, focused on the musculoskeletal system of children, specifically on the issue of poor posture and scoliosis.

- **Occupational exposure and health outcomes**

This report contains routinely processed data on numbers of employees exposed to harmful substances and factors in occupational environments, and the trend of occupational diseases.

QA/QC quality assurance of laboratory work providing data for the Monitoring System is part of the programmes of the organisations to which the laboratories are affiliated. These are laboratories belonging to health institutes, other institutions or private concerns. The primary elements of safeguarding analysis quality in the Monitoring System laboratories are accreditation or authorization. Most of the participating laboratories subscribe to accreditation methods according to CSN EN ISO/IEC 17025.

2. HEALTH EFFECTS AND RISKS OF AIR POLLUTION

Air quality monitoring includes evaluation of the impact of selected indoor and outdoor air quality indicators. Outdoor air quality is evaluated for the most health relevant pollutants: aerosol (or also suspended) PM_{10} and $PM_{2,5}$ particles, nitrogen dioxide (NO_2), metals (arsenic, cadmium, nickel, lead), benzene and benzo[*a*]pyrene (BaP). Basic information on ambient air quality is obtained from a core network of up to 150 measuring stations in inhabited locations, most of which are managed by the Czech Hydrometeorological Institute (ISKO CHMI). From this network, data from stations measuring basic pollutants and, selectively, heavy metals, polycyclic aromatic hydrocarbons and benzene were included for processing in 2023. A total of 19 measuring stations are operated by health institutes (CS-MON). Air quality measurements cover, at least to a minimum extent, almost 100 sites and 10 Prague districts.

The assessment included data on the level of pollution in the national background, obtained primarily within the framework of relevant measurement programs at the EMEP stations (Co-operative programme for the monitoring and evaluation of the long range transmission of air pollutants in Europe), operated by the Czech Meteorological Institute in Košetice and Bílý Kříž, as well as from other suitably located stations. To assess the impact of traffic load, data from extremely busy stations ("traffic hot spots") in Prague, Brno, Ústí nad Labem and Ostrava are used.

Key findings

In 2023, the level of outdoor air pollution improved slightly compared to 2022 for all substances monitored across the board.

In the period from 2014 to 2023, a decreasing trend in the annual mean values of aerosol particle concentrations (PM2.5 fraction) was detected, although at most stations the annual mean concentrations exceeded the WHO recommendations.

The estimated share of deaths due to long-term exposure to aerosol particles in the total number of deaths ranged from zero in urban locations without traffic load to approximately 3.3% of premature deaths in locations most heavily burdened by industry and transport (with the highest average annual concentration of this pollutant).

The estimated increase in cancer risk due to exposure to outdoor air pollutants ranged from 2 to 48 cases per 100,000 inhabitants, depending on the locality, with an average of 7 cases per 100,000 inhabitants. These values have remained essentially unchanged for several years, with the largest long-term contribution coming from exposure to carcinogenic polycyclic aromatic hydrocarbons.

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3. HEALTH EFFECTS AND RISKS OF WATER POLLUTION

Since 2004, data on drinking water quality has been obtained using the drinking water information system (IS PiVo) which is administered by the Ministry of Health and includes all water systems and other public drinking water supply methods in the Czech Republic. The source of this data is mainly from analyses provided by operators. The implementation, frequency and scope of these analyses is prescribed by valid legislation; only a small part of the data has been provided by the public health service under national health supervision. Only analyses performed by validly accredited and authorised laboratories with correct operational procedures can be entered into the system. Processing of data on drinking water quality does not include data from emergency situations, which are minimal in the database. Water quality indicators are assessed according to Decree No. 252/2004 Coll., as amended, which establishes hygiene requirements for drinking and heated water, and the frequency and scope of drinking water control. This decree transposes the European Council Directive 98/83/EC.

According to the Czech Statistical Office, approximately 96% of the Czech population is supplied with drinking water from the public water supply. According to data obtained from IS PiVo, 38% of the population in 2023 was supplied with drinking water produced from underground sources (3,562 water systems), 38% of the population from surface sources (324 water systems) and 24% of the population from mixed sources (215 water systems).

In 2023, a total of 4,101 public water supply systems were monitored. The majority (3,828) are small water supply systems supplying 5,000 or fewer inhabitants, of which 3,302 water supply systems supply less than 1,000 inhabitants. Only 273 water mains belonged to the large category with more than 5,000 inhabitants supplied. However, these water supply systems supply the vast majority of the population of the Czech Republic (approx. 80%) connected to the public water supply system.

Key findings

The gradual improvement of the quality of drinking water from public water supplies according to indicators monitored between 2004 and 2015 stopped in the following years. The main reason is the monitoring of a wider range of pesticide substances with more frequent cases of exceeding limit values.

In terms of health risks known so far, the most problematic contaminants of drinking water are nitrates and chloroform, the latter being formed as a result of water disinfection. Drinking water from public water supplies draws on average approximately 7-10% of the total amount of nitrates and 1% of chloroform, which can be ingested daily without health consequences. The intake of pesticide substances through drinking water does not even reach 1% of their exposure limit.

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4. DIETARY EXPOSURE

A total of five sub-projects were underway in the 2023 monitoring period. The initial project was a **food sampling system** based on methodological requirements for dietary exposure assessment based on the principles of the Total Diet Study (TDS). Sampling is carried out to represent the "usual Czech diet" and food sampling sites are continuously rotated to achieve proportional coverage of all regions of the Czech Republic.

Another part of the subsystem is devoted to monitoring **the occurrence of foods based on genetically modified organisms** (GMOs). In this case, the main concern is the implementation of the precautionary principle.

Monitoring of **selected toxigenic moulds in foodstuffs on the Czech market** is also repeated regularly. Specialised mycological testing is carried out, which is aimed at describing and characterising the risk of toxinogenic fungi. In the Czech Republic, there are virtually no current data on the extent of qualitative and quantitative contamination of food with fungi, nor data on the occurrence of producers of significant mycotoxins in food. The project tries to describe the current situation related to climate change and food imports from different parts of the world.

An extensive part of the subsystem is long-term monitoring of **dietary exposure of the population to selected harmful chemicals**. It is firmly anchored in a number of Czech regulations (e.g. Act on the Protection of Public Health No. 258/2000 Coll. as amended, Government Resolutions No. 323/2021 and No. 200/2022) and in EU regulations, of course. It uses the TDS design, which is methodologically harmonised in the EU (EFSA). It is particularly suitable for chronic dietary exposure monitoring. It differs from conventional food inspection in it covering the whole pattern of consumer behaviour (including culinary food preparation) and dealing with the whole range of foods normally consumed (not just the risk groups). It is therefore a cost-effective way to perform more accurate characterisation of health risks to the population. In 2023, the second year of a two-year sampling period (2022–2023) was conducted.

Key findings

There is still widespread contamination of the food basket with previously used persistent organic compounds, banned by the Stockholm Convention. Given the low dietary exposure, individual substances do not pose a significant health risk; however, an increased risk of real mixtures of monitored substances cannot be ruled out.

• Exposure limits for inorganic substances are on average the highest in the case of nitrites and cadmium. The level of health risk resulting from dietary exposure to lead can be considered acceptable from a public health perspective.

• Exposure to chemical substances estimated according to the recommended food intake model traditionally reaches the highest values for the category of children aged 4-6 years due to the relatively higher food consumption in relation to body weight in children compared to adults.

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5. HUMAN BIOMONITORING

The NIPH Prague has been monitoring chemicals with hormone-disrupting effects since the launch of the Monitoring System in 1994. Since then, the human monitoring program has regularly monitored toxic metals (metals with endocrine disrupting effects includes, for example, cadmium), polychlorinated biphenyls (PCBs) and chlorinated pesticides (DDT metabolites, hexachlorocyclohexane, hexachlorobenzene). Based on the development of knowledge and laboratory methods, other substances with these effects, such as bisphenols, phthalates, per- and polyfluorinated compounds (PFAS) and flame retardants, have been included in the monitoring. In the current HBM study, we also focus for the first time on so-called modern pesticides.

Key findings

A number of widely used chemicals have the ability to disrupt the human endocrine system and thus cause health damage.

Epidemiological studies provide increasingly strong evidence that endocrine disruptors are likely responsible for the negative changes in the health status of populations currently observed.

The NIPH Prague has been regularly monitoring chemicals with hormone-disrupting effects in the biological material of the Czech population since the launch of the Monitoring System in 1994.

In the biological material of each individual, including children, we detect the presence of a mix of endocrine disruptors, such as polychlorinated biphenyls and other chlorinated organic compounds, bisphenols, per- and polyfluorinated compounds or flame retardants and their substitutes.

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6. POPULATION HEALTH SURVEYS

Scoliotic curvature of the spine is a curvature disorder in the frontal plane (back view). It can manifest as a functional disorder (scoliotic posture), where the lateral deviation of the spine can be compensated for by muscular effort. It can be associated with different heights of the shoulders, shoulder blades and hips. If the scoliotic curvature of the spine is already a deformity with changes in the structure of the spine (fixed defect), which is X-ray demonstrable, it is a disease called scoliosis. This disorder affects the entire function of the spine and in its consequences (deformation of the chest) can even lead to reduced vital capacity of the lungs.

Testing of children according to the methodology developed together with the rehabilitation center took place in 2023 in 2 Prague schools, 2 schools in Brno and the Ústí nad Labem region (in Ústí nad Labem and in Lovosice) and in 1 school in the Ostrava region in Klimkovice. This involved performing a simple Adams test, which is used to identify cases that need to be checked more often than during the

interval of preventive examinations. During the test, the child bends forward and slowly straightens up, while the examiner assesses the shape/curvature of the spine from behind. In the case of a visible difference between the left and right half of the back, the Adams test was supplemented by measuring the deviation with a scoliometer, which serves as more accurate evidence of prominence in the thoracic or lumbar region.

Key findings

In a screening examination of scoliotic curvature of the spine in primary school children using the Adams test and scoliometer, 80% of the children had a physiological or almost physiological finding; on the contrary, 5% of the children had a higher degree of deviation indicating the possible occurrence of scoliosis.

Poor posture was found in more than a third of younger school children. Only less than 10% of the children had excellent posture, i.e. without any deviation detected.

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7. OCCUPATIONAL HEALTH RISKS AND THEIR CONSEQUENCES

The data source for monitoring exposure to work-related risk factors and conditions is the Information System of Job Categorisation (IS KaPr). Within this system, every employer is required to assess the risks and classify the jobs performed at their workplaces into one of the 4 categories, depending on the occurrence and severity of the risk factors. According to the data from IS KaPr, as of June 6, 2024, there were 547 049 individuals registered in the risk occupation category (categories 2R, 3, 4). In category 4, which represents highly risky workplaces, there were 13 182 individuals categorised in the Czech Republic, a decrease of 181 employees compared to the previous period.

In the Czech Republic, in 2023, there was an increase in reported occupational diseases mainly caused by the COVID-19 epidemic. A total of 7 001 occupational diseases were diagnosed in 6 156 individuals The incidence of occupational diseases was 147.3 cases per 100 000 employees in the civilian sector.

Key findings

By mid-2024, over half a million employees were registered in the categories of risky work, of which more than 13 thousand people were in the category of high-risk work. The most common risk factor at work is excessive physical strain, inappropriate working position and noise. The largest number of employees in risky work is traditionally in the Moravian-Silesian Region.

Compared to the previous year, a slight decrease was recorded in the total number of reported occupational diseases. For the third year in a row, women account for the majority of those affected. The reason is that the dominant disease in 2023 was again covid-19, and healthcare and social workers were most affected. This changed the decades-long predominance of occupational diseases in the male population.

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