Concentrations of heavy metals in dust samples from Warsaw households

Dust-Catchers

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Academia interviews Prof. Maria Jeleńska--Tiesseyre about her research into concentrations of heavy metals in dust samples collected from Warsaw households

Tell us about your team. Isn't it exclusively female?

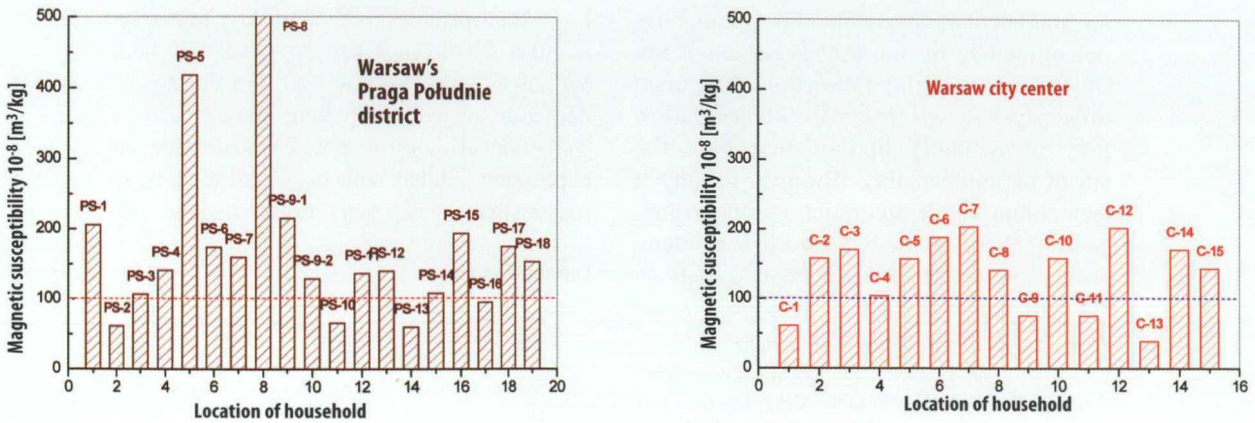
That's right; I work together with Dr. Beata Górka-Kostrubiec and Dr. Elżbieta Król.

You are addressing a common yet important issue: studying levels of heavy metal contamination in dust collected from Warsaw households. It's a fascinating idea, if only because it concerns us all.

I'm glad you think our research is important. I'm keen for as many people as possible to find out about our results. For example, when I see someone pushing a pram right next to a busy road, I'm immediately tempted to warn them that right at that moment, the baby is breathing the most polluted air in the city. But we wanted to find out what happens in our homes: are we safe once we've closed our front doors? It turns out that pollution at home can be very high, almost as bad as out on the street. It permeates through doors, windows and ventilators; we bring it in on our shoes, our pets on their paws. Our homes contain a mixture of contaminants from the air and the soil. There is a lot of talk these days about dust mites, chemicals such as paints and lacquers, but very little about heavy metals. And yet they are insidious substances that get into your body and remain there in your bones and liver. Even neutral dust can be dangerous, when it gets into the lungs.

How do you assess levels of dust contamination? Have you devised a new methodology? It seems that no one has conducted similar research before.

We have been using a magnetic method to determine levels of soil contamination in cities and industrial regions. It turns out that magnetic parameters, in particular magnetic susceptibility, provide a good approximation of pollution with heavy metals. The method is also used in studies of the degree of contamination of dust floating in the air and settling on leaves and in filters. We have studied soil along Warsaw's streets, and investigated air pollution in Warsaw in the 1970s and 80s using archived air filters, or – more precisely – the sediment they collected. That was an era of strikes, so whenever industrial plants were in stand-down they generated significantly lower levels of pollution. The magnetic method allows us to quickly and cheaply monitor the relative degree of pollution, and select high-risk points to be monitored further. Previous conducted focused on outside air, whereas we are the first team to study the situation inside our homes. We compared our results against soil analysis from areas including industrial regions in Silesia. The soil there is very heavily polluted, with the average level of 250 magnetic susceptibility units (a measurement of a given matter's ability to become magnetized inside a magnetic field). The situation is better in Warsaw: here, magnetic susceptibility in the soil is 100 units on average, and household dust is similar.



The degree of heavy-metal dust contamination depends on location

Jakub Ostałowski

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How can this soil standard be related to dust?

We have the highest levels of data available for soil, but there were no results for household dust. We can compare magnetic susceptibility of a gram of household dust against the magnetic susceptibility of a gram of soil in order to compare heavy metal content in the substances.

What does studying the dust pollution in households look like in practice?

We collect dust from vacuum cleaner bags and examine it in our lab, using methods similar to those used to study soil samples. We measured magnetic susceptibility and many other parameters allowing us to define the degree of pollution in households, as well as the type of magnetic particles contained in dust. In turn, this allows us to determine the source of the pollutants.

What's the most common source of pollution?

Urban transport is largely responsible. The results reveal that in areas with higher volumes of traffic, household pollution reaches higher levels. However, they are also affected by ventilation. A major thoroughfare in which air currents blow away pollutants can be less dangerous than a quiet side street; although there are fewer cars, they drive more slowly, slow down for ramps, and there are fewer air currents. It also turns out that the degree of pollution is not affected by the height above ground; our intuition suggests that pollution should be lower on higher stories of buildings, but that's not the case. There can be significant local variation on the ground floor, perhaps because there is a mechanic's garage nearby or the windows happen to look out over a small, busy road; this is not the case at higher levels, and yet pollution levels are similar regardless of height.

And you also discovered that the situation isn't much better on the outskirts of Warsaw.

Surprisingly, small towns can also be heavily polluted. While there is less transport and industry, people tend to use stoves more and burn rubbish.

Is there much variation throughout the capital?

We have studied 150 households so far; we don't have representative data from all districts, but we can already see certain patterns emerging. In the majority of households, magnetic susceptibility falls between 100-150 units. Clean soil registers at around 20 units. Sometimes we record some extreme results. We suspect that they are due to local and temporal variation, such as DIY or renovation work taking place. Such variation is not statistically significant, although we are able to study it regardless of the source of the pollution. There are few spikes in the Warsaw city center; however, the center is generally more heavily polluted than average. This is also the case with the Praga district, most likely due to the factories, industrial plants, and railway works located in the area. The situation is better in the Mokotów and Ursynów districts, which have the lowest levels of pollution.

I also noticed a distinct variation throughout the year.

Yes, for instance I have results from a small residential street in Mokotów. Pollution is slightly higher in the autumn and slightly lower in winter, but the variation is low. However, results obtained in Białołęka show significant variation. Pollution levels in dust are much higher in the autumn than at other times of the year. There are more small family homes in the district, and municipal central heating is less widely available than in older districts. As soon as it starts getting cold, people start burning things in their stoves, frequently using rubbish, generating higher levels of pollution than municipal central heating.

In winter, the levels of contaminants are slightly lower throughout the city. This is likely due to air temperature and circulation. Cities are islands of heat; air currents circulate from warmer to colder zones, so in winter the city is better ventilated. Additionally, there are fewer cars around at this time of the year. But so far these are just guesses, and we're currently testing our hypotheses.

Are there locations with lower levels of pollution?

The further away from the street, the better. It would be a good idea for urban planners to separate roads from houses with a strip of greenery. They are very beneficial in keeping us away from the highest concentrations of heavy metals. We have also noted that the highest concentrations of metals occur at junctions with traffic lights: cars stop to rest, and their emissions aren't distributed fast enough. The situation is similar with cars driving up or down inclines. And at home? Well, we should simply vacuum as often as possible.

Interview by **Patrycja Dołowy**
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