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Impacts of water and air pollution on human health: The case of Emalahleni

Immediate action to remediate river water quality and educate communities about hygienic water storage practices is required in vulnerable communities south of Emalahleni (formerly known as Witbank), Mpumalanga.

Results from environmental monitoring to inform a health risk assessment as well as a household survey showed that residents of these communities stood a 10 – 60% chance of becoming sick from contaminated river water, as well as from tap water from outside standpipes and water storage containers in their homes.

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In 2011, researchers surveyed 1 003 households in the vulnerable communities of KwaGuqa, Vosman and Empumelelweni south of Emalahleni, Mpumalanga. These communities live close to a highly-polluted river, the Brugspruit, a tributary of the Olifants River.

The survey included drinking water and river water analyses, as well as monitoring of ambient air quality in order to gain a holistic picture of the various environmental impacts on the health of these communities:

- Heads of households were interviewed about demographics; possible exposure to river water and air pollutants; use of the local stream; sanitation; solid waste removal; nutrition; energy use; health and healthcare; personal hygiene; and socio-economic factors.
- River and household water samples were tested for water quality. Microbiologists tested the river water for pathogenic organisms; and treated drinking water for indicators of pollution. These results were used to predict the health risks of consuming the water.
- Ambient air quality monitoring was done for one month (during the household survey) in the community measuring ambient levels of particulate matter, sulphur dioxide, nitrogen dioxide, lead and transition metals such as mercury and manganese. The Department of Environmental Affairs provided local ambient air quality data.

Water heavily contaminated

The river water was heavily contaminated with faecally-derived micro-organisms, possibly from informal settlement run-off in the area and a waste water treatment works located three kilometres upstream of the site. Results also showed that the river water was contaminated with disease-causing bacteria, protozoan parasites and virus pathogens.

Residents of communities living close to the stream stood a chance of 10 to 60% of becoming sick if they consumed contaminated river water, water from outside standpipes or water from storage containers in their homes. The World Health Organization regards 0.01% as a realistic risk one should aim for.

While most residents did not use water from the river, there was a significant chance of accidental infection when walking through the river, washing clothes in the river or handling and consuming vegetables watered with river water. One of the most disturbing findings was that storage containers contaminated with viruses was responsible for the greatest risk of getting an infection.

Although virus contamination was detected least, its presence was responsible for the greatest risk of getting an infection, followed by the bacterial pathogens *Vibrio* and *Shigella*. Viruses have a low infective dose – which means only a small number of organisms are needed to cause an infection. The fact that storage containers contained significant levels of viral pathogens implies that residents could be contaminating their own water by, for example, not washing their hands before dipping a cup into the stored water, or taking water from a communal standpipe that has been

contaminated by a person carrying a disease-causing micro-organism.

As many chemicals such as pesticides, detergents, plasticisers and others, are able to disrupt the endocrine system, oestrogen-mimicking activity was tested in the river water. Levels of oestrogen-mimicking activity were found to be at concentrations close to 10 times that considered safe for drinking water. This highlights the importance of ensuring that the drinking water treatment works is operating optimally to remove the oestrogen-mimicking chemicals.

Impacts of air pollution

We evaluated the risks to human health from particulate matter (PM_{10}), sulphur dioxide, nitrogen dioxide, lead and the transition metals, mercury and manganese. This was done according to the United States Environmental Protection Agency (USEPA) human health risk assessment (HHRA) approach. We found that there was a likely risk of neurological effects if people are chronically exposed to the monitored manganese concentrations. However, long-term monitoring is needed to verify these results.

What actions are required?

According to the *2011 Blue Drop and Green Drop* reports of the Department of Water Affairs, which monitors the performance of drinking water and wastewater services, the drinking water treatment works in the area only scored 46% for their performance. This highlights the need to ensure that water treatment works are operating effectively to remove the pathogenic microorganisms and the endocrine disrupting chemicals that are present in the intake water.

We also recommend monitoring of criteria air pollutants; as well as screening monitoring of transition metals to determine hot-spot areas where continuous monitoring may be required.

What can communities do?

Communities can protect themselves by avoiding direct contact with river water, and employing safe and hygienic water storage practices, such as keeping containers closed and cleaning them regularly.

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