Large-scale mercury lab on the cards

Sampling water for mercury analyses in the Kuils River, Western Cape

The CSIR is in the process of setting up a large-scale mercury reference laboratory as part of the comprehensive South African Mercury Assessment (SAMA) programme.

"An important aspect of our research focus on mercury is the development of local capacity in mercury sampling and analysis," says Dr Joy Leaner of CSIR Natural Resources and the Environment, and coordinator of the SAMA programme.

Very little is known about the extent of mercury pollution in South Africa, because until now most studies have been in response to emergency incidents and effluent spills. To address this knowledge gap, the SAMA programme was set up in March 2006 with the aim of developing a framework for mercury-related research. It is a partnership programme with representatives from government, academia, industry, and parastatal and non-governmental organisations.

When it was implied that South Africa was the world's second worst polluter in terms of mercury emissions (Pacyna et al. 2006), local scientists could not confirm or deny the claims. "We suspect that South Africa's mercury emissions are not as high as has been suggested because the estimated emissions were based on volumes of coal combustion and gold production, yet the gold industry has largely phased out the use of mercury," says Leaner.

Leaner is also the leader for a recently initiated research project - funded by the Water Research Commission (WRC) - to investigate mercury levels in South African water resources.

Mercury is particularly dangerous once it gets into aquatic systems, because under certain conditions it is converted into methylmercury - a more toxic form. It is readily taken up by phytoplankton and then accumulates up the food chain, with the result that people eating methylmercury-contaminated fish on a regular basis soon experience the symptoms of mercury poisoning.

"Mercury attacks the central nervous system, so dementia, memory loss and speech and gait problems are typical symptoms of mercury poisoning," says Leaner. "The term as 'mad as a hatter' was coined because, in the old days, mercury was used in the manufacture of felt hats, so mercury poisoning was somewhat of an occupational hazard!"

The main focus of the WRC project - which began in April 2007 - is to conduct a national survey of mercury levels in water resources by sampling water, sediment, and freshwater fish and invertebrates from all 19 of South Africa's Water Management Areas (WMAs). Sampling sites were selected on the basis of their proximity to likely sources of mercury emissions, and those shown to have markedly high levels of mercury will be identified as 'hotspots' for more intensive study.

Coal-fired power stations are the primary source of mercury emissions globally, and given that most of South Africa's power stations are located in Mpumalanga - where 80% of the country's coal are produced - the Olifants WMA will come under special scrutiny. Another major mercury emitter is the cement industry, which uses coal as a kiln fuel. Although the cement industry is more evenly distributed throughout South Africa,

there is a concentration of facilities in the Crocodile (West) and Marico WMA, which will be sampled intensively by the research team.

"We'll also be focusing on the Barberton area, located in the Inkomati WMA," reports Leaner, "where artisanal gold mining took place in the past. Worldwide, mercury is still used by small-scale miners to form an amalgam, after which it is burnt off over an open flame. Obviously such practices pose a threat to their health, as well as to people who consume mercury-contaminated fish from freshwater ecosystems nearby."

Recent media reports indicate that the practice is even carried out in hostels housing illegal miners, popularly known as 'gold pirates' or '*zama-zamas*'. The day after a police raid of the Welkom municipality's G Hostel, journalists were shown a variety of blackened containers used to burn off mercury. The impact of these activities remains unclear.

Much can be learned from international experts from the University of Connecticut, who - together with scientists from Stellenbosch University - are collaborators on the WRC project. At present, all samples collected by the project team are sent to the USA for analysis, but the American collaborators are helping to set up a mercury laboratory at the CSIR.

"Our intention is to develop a large-scale mercury reference laboratory, that will focus primarily on mercury research, but will also provide analytical services to others to a certain degree," says Leaner. "We'll adhere to the methods of the USA's Environmental Protection Agency, which are considered standard protocols."

Technical expertise of this kind is likely to become all the more important if South Africa follows the example of the USA and the EU, where tighter controls on mercury emissions are being introduced. In the meantime, the national survey will yield a better understanding of mercury pollution in South Africa, providing support for future government initiatives aimed at addressing the problem.