



Mercury study shows surprising results

Preliminary results from South Africa's first comprehensive national study of mercury in the country's water resources indicate that levels are lower than feared.

The investigation, which is nearing completion, has taken CSIR researchers to over 70 sampling sites covering all 19 water management areas. According to project leader Dr Vernon Somerset the project is an attempt to understand the condition of South Africa's water and atmosphere in terms of mercury released into the environment; how it builds up (bioaccumulates) in the aquatic food chain; and what its impact is on water resources and human health.

Mercury is typically released into the environment through coal combustion, waste incineration, base-metal smelting, gold and cement production. "Since South Africa uses coal to produce energy, mercury is potentially released into the environment at our coal-fired power stations. Some of this mercury ends up in our water ecosystems through wet and dry deposition. It is therefore crucial to monitor and manage mercury," said Dr Somerset.

Dr Stanley Liphadzi, Director: Water & the Environment at the Water Research Commission, one of the

main stakeholders and partial funder of the studies, said the Commission had been keenly following the results and looked forward to studying the final report, scheduled for release later this year. This report will show the range of mercury concentrations in sediment, invertebrates and water at various sites. "The results will also help us identify hotspots in the country, where focused interventions should be aimed at," he noted.

Dr Somerset warned that, while some concentrations may be perceived as being relatively low, mercury emission remains a concern due to biomagnification in aquatic food chains. "Inorganic mercury can be transformed under specific conditions into a more toxic organic form, called methylmercury that is able to bioaccumulate in the food chain, ending up in fish consumed by humans. This can result in people eating methylmercury-contaminated fish on a regular basis and after a while experiencing symptoms of mercury poisoning."

The samples collected are analysed in the newly established mercury reference laboratory at CSIR's regional office in Stellenbosch to further provide accurate data on the total mercury and methylmercury concentrations in these samples at the parts per trillion concentration level. The data obtained from the national survey will also provide input into the human health aspects of possible high mercury concentrations in freshwater systems.

"Our focus is now on completing the last field survey and analysing all the samples," reported Somerset. Ultimately, the researchers hope to establish a framework for mercury mapping as well as to provide input into the formulation of evidence-based policies, which will help with mercury monitoring and management at a national and regional scale. "This will act as a benchmark against which the success of national management initiatives can be measured," said Dr Somerset.

Source: CSIR

MASTERS DEGREE

PART-TIME OVER TWO YEARS IN

ENVIRONMENTAL MANAGEMENT

"Sustainability depends on functioning environmental services"



Centre for Environmental Management
University of the Free State
Tel: 051 401 2863
Fax: 051 401 2629
Email: cem@ufs.ac.za
Website: www.ufs.ac.za/cem





Scott Fendorf

Scientists solve puzzle of arsenic-poisoning crisis in Asia

Scientists at Stanford University, in the US, have discovered how arsenic enters the groundwater below the Himalayas.

Every day, more than 140 million people in southern Asia drink groundwater contaminated with arsenic, leading to thousands of cancer deaths a year. In the Himalaya Mountains sediments containing naturally occurring arsenic are carried downstream to heavily populated river basins below. However one mystery remained: instead of remaining chemically trapped in the river sediments, arsenic was somehow working its way into the groundwater metres below the surface.

The study to find the answer to this question was launched in 2004, focusing on the Mekong River in Cambodia. Scientists had long assumed that the contamination process occurred deep underground, in buried sediments that release arsenic into the aquifers. However, the Stanford team, led by soil scientist Scott Fendorf, found that within the first metre from the surface, arsenic was coming out of the solids and into the water, and then it migrated down into the aquifer.

The culprits responsible for dissolving the arsenic turned out to be bacteria that live in the soil and sediment of the river basin. The researchers discovered that arsenic flowing down the river from the Himalayas sticks to rust particles (iron oxides). Upon reaching the river delta these arsenic-laden particles are buried by several layers of soil, creating an anaerobic environment. As the bacteria metabolise the iron and arsenic, they convert it to a form that readily dissolves in water.

"As these sediments get buried very rapidly, the bacteria go through an anaerobic metabolism that dissolves the iron minerals and the arsenic with it," explained Fendorf. "The arsenic goes into the water and the problem starts."

The results, published in the journal *Nature*, noted that arsenic contamination was occurring near the surface and, in fact, would take at least 100 years to reach the aquifer below. The Stanford team also showed that the 100-year-scale cycling of arsenic into the aquifer was a natural process that had been occurring for thousands of years, preceding any human influence.



China tackles vast water quality issues

A project to improve water quality in China has been launched by the government.

This is reportedly the largest State expenditure on environmental protection since the founding of the People's Republic in 1949.

SciDev.Net reports that the project, which has an estimated budget of more than 30 billion Chinese yuan (about US\$4.4-billion) over 12 years, aims to counter the deteriorating water quality affecting millions of Chinese people and their livelihoods. The Water Pollution Control and Management Project will focus on the treatment of whole river basins instead of the conventional approach of end-of-pipe treatment, according to Meng Wei, chief engineer of the project and director of the Chinese Research Academy of Environmental Sciences. By taking this approach the treatment of the highly polluted Lake Tai, for example, the third-largest freshwater lake in China, will benefit not just Shanghai but also the eastern provinces of Jiangsu and Zhejiang.

Pesticide review sees mass removal of substances from market

The detailed human health and environmental risk assessment by the European Commission (EC) of some 1 000 active substances authorised for use in pesticides before 1991 has led to the removal of more than two thirds of them from the market.

The risk assessment review evaluated each substance with respect to the health of consumers, farmers, groundwater and non-target organisms, such as birds, mammals, earthworms and bees. According to the EC, there were around 1 000

active substances contained in tens of thousands of products on the market when the review was launched in 1993. The review has led "to the removal from the market of more than two thirds of these substances," said Health Commissioner Androulla Vassiliou. The majority of substances (about 67%) were eliminated because "dossiers were either not submitted, were incomplete or were withdrawn by the industry," the EC said. Some 70 substances were withdrawn from the market because the evaluation revealed risks to human health and the environment.

Time of conception linked to birth defects in US

A study published in the April 2009 issue of the medical journal *Acta Paediatrica* is the first to report that birth defect rates in the US were highest for women conceiving in the spring and summer. The researchers also found that this period of increase correlated with increased levels of pesticides in surface water across the US.

Studying all 30,1 million births which occurred in the US between 1996 and 2002, the researchers found a strong association between the increased number of birth defects in children of women who conceived in April, May, June or July and elevated levels of nitrates, atrazine and other pesticides in surface water during the same months. While many of these chemicals, including the herbicide atrazine which is banned in Europe but permitted in the US, are suspected to be harmful to the developing embryo, this is the first study to link their increased seasonal concentration in surface water with the peak in birth defects in infants conceived in the same months.

"While our study did not prove a cause and effect link, the fact that birth defects and pesticides in surface water peak during the same four months makes us suspect that the two are related," said Dr Paul Winchester, Indiana University School of Medicine professor of clinical paediatrics, the first author of the study. "Birth defects, which affect about three out of hundred newborns in the US, are one of the leading causes of infant death. What we are most excited about is that if our suspicions are right and pesticides are contributing to birth defect risk, we can reverse or modify the factors that are causing these lifelong and often very serious medical problems," noted Dr Winchester.

Indian sanitation innovator wins global award

Indian sanitation innovator and social reformer Dr Bindeshwar Pathak has been awarded the 2009 Stockholm Water Prize.

As the founder of the Sulabh International Social Service Organisation, Dr Pathak is known around the world for his wide ranging work in the sanitation field to improve public health, advance social progress, and improve human rights in India. His accomplishments span the fields of sanitation technology, social enterprise, and healthcare education for millions people in his native country, serving as a model for non-governmental agencies and public health initiatives around the world.

Dr Pathak has worked since the 1970s to develop cost-effective toilet systems and waged an ongoing campaign to abolish the traditional practice of manual 'scavenging' of human waste from bucket latrines in India while championing the rights of former scavengers and their families to economic opportunity, decent standards of living, and social dignity.



Dr Bindeshwar Pathak with a Sulabh Shauchalaya toilet

World's major rivers disappearing

Climate change, and an increased threat to water supplies are causing some of the developing world's largest rivers to dry up, SciDev.Net reports. Researchers from the US-based National Centre for Atmospheric Research (NCAR) analysed data combined with computer models to assess flow in 925 rivers – nearly three-quarters of the world's running water supply – between 1948 and 2004. A third of these had registered a change in flow and most of them – including the Niger in West Africa, the Ganges in South Asia and the Yellow River in China – were dryer.

"Reduced runoff is increasing the pressure on freshwater resources in much of the world, especially with more demand for water as population increases. Freshwater being a vital resource, the downward trends are a great concern," reported Aiguo Dai, a scientist at NCAR and lead author of the research. According to the researchers rivers are losing their water due to a variety of reasons, including the installation of dams and the use of water for agriculture. But in many cases the decrease in flow is because of climate change, which is altering rainfall patterns and increasing evaporation because of

higher temperatures.

As well as endangering water supplies, the decreased river flow could affect the world's climate. If less freshwater is discharged into the oceans they become saltier, which could affect salinity- and temperature-driven ocean circulation patterns that, in turn, play a fundamental role in climate regulation.

Sewage treatment plants breeding grounds for 'superbugs'

Research in the US has shown that antibiotic-resistant 'superbugs' being created in urban wastewater plants are finding their way into freshwater resources.

In the first known study of its kind, Chuanwu Xi of the University of Michigan School of Public Health and his team sampled water containing the bacteria *Acinetobacter* at five sites in and around the city of Ann Arbor's wastewater treatment plant. They found the so-called superbugs – bacteria resistant to multiple antibiotics – up to 90 m downstream from the discharge point into the Huron River.

Xi, an Assistant Professor of Public Health, stresses that while the finding may be disturbing, it is important to understand that much work is still needed to assess what risk, if any, the presence of superbugs in aquatic environments poses to humans. Xi and colleagues found that while the total number of bacteria left in the final discharge effluent declined dramatically after treatment, the remaining bacteria were significantly more likely to resist multiple antibiotics than bacteria in water samples upstream. Some strains resisted as many as seven of eight antibiotics tested.

Multiple antibiotic-resistant bacteria have emerged as a public health issue worldwide in the last few decades as the overuse of antibiotics and other factors have caused bacteria to become resistant to common drugs.

Global news in brief

- ◆ China has clamped down heavily on a company that polluted a major freshwater lake with arsenic, fining it US\$2,34-million and sentencing three of its senior executives to jail terms. Yunnan Chengjiang Jinye Industrial and Trade Company was found guilty of polluting the waters of the 30 km² Yangzonghai Lake, one of the plateau lakes of the Yunnan Province.
- ◆ India and Pakistan have agreed to incorporate a new clause into the Indus Waters treaty during the annual meeting of the Permanent Commission, intended to strengthen the commission's role.
- ◆ According to a report of the African Development Bank, more than 73% of Rwandans now have access to safe drinking water, 2% up on the year before. The document also reveals that 45% of the country's population now have access to improved sanitary facilities.
- ◆ The World Bank has approved an additional grant of US\$33,5-million to help restore irrigated agricultural production in Afghanistan's rural communities through improved and reliable water supply to irrigation schemes. The additional funds will support the continuation of the country's emergency irrigation rehabilitation project, which is part of a wider effort to rehabilitate and restore irrigation infrastructure.

Source: IWA