

## TOXICOLOGY

# Swimming into 'toxic' waters

*The colour of that azure swimming pool water may come at a cost, as the chemicals required to produce it could be endangering your health, writes Marika Sboros*

SUMMER'S here, the mercury's rising, and your swimming pool is an inviting and pristine Mediterranean blue. It's the same colour of the indoor pool at your local gym that helped you keep fit in winter, and the spa pool you relaxed in last month.

That colour may come at a cost, as the chemicals that produce it could be a health risk.

An international team of Spanish, Greek, US and German scientists says swimming in indoor chlorinated pools may induce genotoxicity — DNA damage that may lead to cancer — and have respiratory effects. Their research is restricted to indoor pools, but the experts point out that the concerns apply to outdoor pool as well.

The study, led by scientists at the Centre for Research in Environmental Epidemiology in Barcelona, is in three articles online ahead of print in the peer-reviewed journal *Environmental Health Perspectives*.

They say disinfection byproducts (DBPs) form in pool water from reactions between disinfectants such as chlorine and organic matter either present naturally or introduced by swimmers — sweat, skin cells, and urine.

The scientists used molecular markers of genotoxicity and cancer to show that just 40 minutes of swimming is all it takes to produce high levels of DBPs in the body and activate these markers. They identified more than 100 DBPs in the pool waters, some not reported previously in pool or chlorinated drinking water.

They say in vitro assays showed the pool water was mutagenic at levels similar to drinking water, but more cytotoxic (can kill cells at a lower concentration) than drinking water.

The authors conclude that swimming in a chlorinated pool is “an unacceptable cancer risk”.

Cape Town molecular geneticist Dr Ronelle Roth agrees, and not just because she is sole distributor for an innovative South African water sanitation technology product that creates water that is 100% chlorine free.

Roth has a PhD from Oxford University in the UK and was a senior lecturer in genetics at Stellenbosch University. As a molecular geneticist and mother of two young children, she says she is particularly interested in the effects of chemicals on health and the environment, and the effects of chlorine at molecular level.

As a scientist, she says she requires data to back up claims, and the evidence is there to show that many pesticides and herbicides are man-made organochlorines.

“Organochlorine are useful because they are very stable molecules, but also bad because many are carcinogenic (xenoestrogens) and they accumulate in the environment,” Roth says.

Some of the most harmful known chemical compounds are “the dirty dozen”, she says. These are 12 compounds, eight of which are chlorinated compounds. There have been moves to phase them out worldwide because of their toxicity and carcinogenicity.

Studies have looked at the carcinogenic effects of DBPs in drinking water and more recently in swimming pools, says Roth.

“Chlorine is a very reactive element, so when added to water it immediately reacts with organic matter in the water to form organochlorines or DBPs — known as chlorine demand or combined chlorine.

“ The remaining chlorine (free chlorine) produces hypochlorous acid, which is the main chemical oxidiser/disinfectant.

“Since organochlorines are fat-loving, they are readily absorbed through the skin where they bypass the liver and accumulate in the organs throughout the body,” Roth says. The more overloaded the pool and the poorer the filtration (a common problem in SA) the more chlorine is needed and the more byproducts will be produced.

One byproduct is chloramine gas — that familiar chlorine smell, says Roth. This is chlorine bound to sweat and urine. Recent Belgian research showed conclusively that chloramines increase the risk for asthma in children, she says.

Chloramines are more prominent in indoor pools due to lack of ventilation, but DBPs are produced in both indoor and outdoor pools, and in both chlorine and salt chlorinated pools, Roth says.

A study by US scientists at the Florida International University, published in the American Journal of Public Health in 1980, showed that the predominant form of DBP in HTH-chlorinated pools is chloroform and in salt- chlorinated pools it is bromoform, Roth says. The Spanish study found bromoform to have the most profound toxic effect.

Other research has showed that salt-chlorinated pools generally contained the highest levels of DBPs, with bromoform levels that measured six to 13 times higher than the World Health Organisation has set as safe for drinking, Roth says.

Bromoform is shown to be highly carcinogenic in animal studies, she says.

The reality is, says Roth, that all pools, indoor or outdoor, generate DBPs when chlorine is added, or generate them from salt via a chlorinator. Outdoor pools often contain more organic debris than indoor pools so the potential to produce DBPs is in fact higher.

An aggravating factor is that because sunlight destroys chlorine, outdoor pools generally require higher levels of chlorine than indoor pools.

“To prevent this, a ‘sunscreen’ for chlorine, isocyanuric acid, is often added to outdoor pools,” Roth says.

She found out about the local e-clear system ([www.eclear.co.za](http://www.eclear.co.za)) from a friend.

“At the time, I was looking for an eco-friendly and healthy alternative to chlorine for swimming pools. I reviewed the science behind the ‘natural freshwater technology’. I was impressed with the technology, based on natural rather than chemical oxidation — and the many prestigious and high profile e-clear installations overseas — all 100% chlorine free, non-toxic and eco-friendly.”

Roth says a huge bonus is that the product was developed and patented by a South African and manufactured in SA.

She and a partner obtained distribution rights for the e-clear systems in Africa in December 2008.

Dr Joseph Mercola, a US natural health specialist, says on his website ([www.mercola.com](http://www.mercola.com)) that the obvious option is simply to avoid swimming in chlorinated pools, as this significantly cuts exposure.

Mercola is an osteopathic physician, also known as a DO. In the US, DOs are licensed physicians who can prescribe medication and perform surgery.

Osteopathic doctors in SA do not perform surgery.

He says swimming is good exercise and you don’t have to give it up just to avoid the chemicals.

“Swimming in an ocean is an excellent alternative,” he says — if you live near the sea.

If you don’t, you can find ways to keep pools clean from bacteria, algae, and other organisms without using dangerous chemicals.

But you need to address other sources of DBPs, such as your tap water, because of all other toxins and contaminations present in your water, such as fluoride and miscellaneous pharmaceutical drugs, DBPs may be the “worst of the bunch”, says Mercola

The chlorine lobby believes its product is not harmful to health, in and out of swimming pools.

The American Chemistry Council on its website ([www.americanchemistry.com](http://www.americanchemistry.com)) responded to a recent study linking chlorine in pools with childhood asthma, saying “there is no conclusive evidence to date showing a link”.

The council says pool owners should remember that disinfecting a pool properly — which includes maintaining appropriate chlorine levels — is essential to controlling germs. Reducing levels below the recommended range creates an environment where pathogens can thrive, causing diarrhoea, ear infections, and skin rashes.

Swimmers can play their part to keep a pool healthy by showering before entering the pool and not urinating in it.

The council says adding chlorine to drinking water is essential to ensure safety and, where widely used, chlorine has helped virtually to eliminate dangerous waterborne diseases.

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