

Our imperilled water

M. FEISAL RAHMAN

As we enter the era of climate change, it is becoming increasingly evident that access to safe drinking water is going to be one of the major challenges around the globe, especially for arid and developing regions of the world. For most part of the developed world the risk of microbial contamination of drinking water is significantly lower. As a result those countries are focusing on chemical contaminants. In the developing and underdeveloped world people are still under constant threat of microbial contamination of drinking water. The recurrence of diarrhoea every year in Bangladesh and the recent cholera outbreak in Zimbabwe are some examples that substantiate the prevailing risk.

While we must keep our focus on microbial contaminants, arsenic contamination in the Bengal basin is a perfect example of what may happen if we do not provide appropriate attention to the chemical contaminants. This article focuses on the occurrences of a class of chemicals that are collectively referred to as endocrine disrupting compounds (EDCs) in water. It also briefly mentions some consequences of the excessive water pollution in Bangladesh.

EDCs are either naturally occurring or synthetic substances that interfere with the functioning of hormone systems resulting in unnatural responses. The endocrine system controls various biological functions such as reproduction, synchronization of physical development and maintenance in animals and plants with the help of hormones. EDCs may act as hormone

mimic by binding to the receptor sites of the target cells and activating a response, or can act as a hormone blocker to prevent natural hormones from interacting. A number of steroid hormones both natural and synthetic, pesticides, herbicides, certain industrial chemicals (such as DDT, DDE etc.), poly aromatic hydrocarbons and dioxins have so far been confirmed as EDCs. Certain Pharmaceuticals and Personal Care Products (PPCPs) can also act as EDCs. PPCPs include pain killers, antibiotics, cholesterol lowering drugs, birth control pills, musk fragrances, hand sanitizers etc.

Many of these EDCs and PPCPs are almost ubiquitous in municipal sewage treatment plant effluents and source waters for drinking water treatment plants at extremely trace concentrations such as nano-grams per litre. Yet they have the potential to cause harm. Humans are indirectly exposed to these micro-pollutants and are unwittingly medicated via drinking water as studies have shown that conventional water treatment systems perform poorly in removing these chemicals from drinking water.

The majority of EDCs and PPCPs occurrence studies have been done in the industrialized countries. Occurrences of these potential contaminants in aquatic environment in most developing countries remain unreported although the risk might be higher in those areas.

EDCs and PPCPs find their way into watercourses by many routes including direct discharges into water, excretion and inappropriate disposal after use of drugs and chemicals by industries and

Safe and potable drinking water is fundamental to human health. Adverse impacts on public health due to increased water pollution are popping up in our media constantly and to a certain extent authorities remain indifferent. Excessive pollution has driven almost all types of macro aquatic species out of the rivers around Dhaka. Recent reports indicate that the pollution is gripping on groundwater as well.

households; agricultural and cattle feedlot runoff; industrial and STP effluents; accidental releases (through spills, run off, atmospheric deposition); and release of compounds indirectly through diffuse sources such as storm water runoff.

In 1994 a study in the United Kingdom found that male fishes exposed to sewage treatment plant effluents were producing eggs and had higher (than usual) concentration of female hormones. Similar feminization phenomenon has since been observed by many other scientists in fish and other wildlife species around the world. Studies have indicated that long-term low-dose exposures to manmade chemicals are causing such changes in the hormone system of the species exposed. A study published in Science reported that in between 1990 and 2004, white-backed vulture population in South Asia went down by as much as 90 percent, pushing this species towards extinction. Veterinary use of the drug diclofenac has been indicted for this decline and this is the first demonstrated acute ecotoxic effect of pharmaceuticals in the environment.

When it comes to the effect on humans the scientific community is still divided. Industrialized countries have seen a sharp increase in hormone-related cancers in



recent years. Incidences of hormone-related cancers are also increasing in the developing world but are probably under-reported. Death from breast cancer is almost ten times higher in North America and Northern Europe than in Asia and Africa. In Puerto Rico, United States, premature breast development (premature thelarche) and early onset of puberty in girls have been reported. Canada in between 1977-1990 has seen a decline in male proportion by 2.2 live births per 1000. The developing world is constantly observing a shift in the epidemiological transition to the suite of chronic illness such as asthma, learning disabilities, congenital malformations and cancers as the leading causes of death. What is causing this shift? We don't have an answer yet. The reason could

very well be the exposure to synthetic chemicals in the air, water soil and food chain. Science has not yet been able to delineate what could be long term low dose synergistic effects of EDCs and PPCPs on humans but scientists are concerned that this could lead to a severe public health disaster.

Emerging water issues such as EDCs and PPCPs are forcing regulatory agencies in the developed world to review standards for drinking water and look for new treatment techniques. Moreover, a significant portion of the contamination is occurring from non-point sources. With growing public concern at the presence of EDCs and PPCPs in water, the drinking water industry faces a challenge as to which compounds should be treated and to what level

they should be treated as maximum contaminant levels remain unknown.

Advanced water treatment technologies such as ozone treatment, advanced oxidation process and membrane processes have been reported by researchers to be successfully removing a wide range of EDCs and PPCPs. However, the cost of operation of such advanced treatment technologies might seem expensive even in some communities in the developed world. Thus advanced water treatment technologies for the removal of EDCs and PPCPs might seem to be a luxury for most developing countries as their water quality programmes are already combating a wide range of problems and are doing so in a constrained economic environment.

There is also a significant gap in scientific knowledge and awareness regarding potential adverse impacts of EDCs and their handling technologies. Absence of proper regulations and enforcement and socio-economic factors have made the risk of exposure to EDCs considerably higher in developing countries. Long-term risks posed by EDCs do not often receive appropriate attention from the government and other concerned agencies in the developing countries. The technologies to handle EDCs and PPCPs will fail if passed to the developing

countries without building their capacity to identify and perceive the ill-effects of EDCs. Research on EDCs should, therefore, be promoted in developing regions as well.

As science advances we are becoming aware of an increased number of agents in our water which might be toxic even at extremely trace concentrations. These contaminants not only pose threat to human health but also to the ecosystem. It is quite understandable that we are predominantly focused on the impacts on human beings. However, we must not forget the other forms of life of the ecosystem and if we continue to disregard them, we will start to feel the repercussions at some point.

Also as access to clean water becomes harder, we must not condone the lurking conflict that may arise from scarcity of water. Sporadic clashes that we often observe in parts of Dhaka may turn severe in future if utilities fail to supply the bare minimum amount of water. The huge economic disparity in our society is also reflected in our water consumption patterns. This may even lead to social conflicts among different classes of the society if water scarcity becomes acute.

In our restricted economic environment the number of burgeoning problems in the water sector might seem extremely challenging to deal with. But they at the same time provide exciting opportunities for the research communities to hone innovative and sustainable technologies to fight those challenges. While many water problems may be global, sustainable solutions remain local. Thus we need to boost water related research,

and appropriate support from different sectors is essential in that regard.

Safe and potable drinking water is fundamental to human health. Adverse impacts on public health due to increased water pollution are popping up in our media constantly and to a certain extent authorities remain indifferent. Excessive pollution has driven almost all types of macro aquatic species out of the rivers around Dhaka. Recent reports indicate that the pollution is gripping on groundwater as well. Conditions of the rivers and other water bodies around the country are also aggravating. Thanks are due to The Daily Star for continually reporting on the intensified pollution and declining quality of our rivers and other sources of water.

Media and the scientific community can work as vanguards of our waters by constantly providing information to develop strong public opinion against pollution. Regardless, strong governmental stance to curb the creeping water pollution is imperative. To meet the increasing demand of water there is no alternative to restore our water bodies. However, responsible participation and cooperation of all stakeholders are indeed vital for the sustainability of any such stance and enforcement of regulations. Years of man made pollution probably has imperilled our water enough to trigger the grudge of nature and we must act before it gets irreversible.

M. Feisal Rahman is a Ph.D. candidate in the department of civil and environmental engineering at the University of Waterloo, Canada. He can be reached at m2rahma@uwaterloo.ca.

Climate change and conflict

DR. MD. RASHED CHOWDHURY

FIVE complementary mechanisms have been proposed to link broad climate change/variability processes to conflict. These are:

(i) Political instability: Economic stagnation, increasing unemployment rates, and costly measures to counter climate change could weaken the state's capacity for governance, including redistribution and political control. These intermediate effects, in turn, have the potential to increase popular grievances and decrease the power and perceived legitimacy of governments relative to opposition movements, thus increasing the risk of conflict.

(ii) Economic instability: Loss of livelihood, unemployment and increasing poverty at the individual level lower the opportunity costs for joining a rebellion. Increasing sense of relative deprivation may also provide motives for marginalized groups to take up arms to alter the status quo.

(iii) Social fragmentation: Adverse consequences of climate change are unlikely to affect all segments of society equally and the consequences may also vary between and

within countries. Negative developments that coincide with prevalent societal cleavages, in particular ethnicity, could accentuate ethnic antagonism and polarization, thereby undermining the unity of a country, in certain cases, and increasing the level of mutual suspicion between groups.

(iv) Migration: Aside from increasing competition over diminishing resources in adverse regions, large-scale population movements in response to declining economic opportunities and increasing vulnerability to the rising sea may instigate resource competition and rivalry between incoming migrants and the established local population.

(v) Inappropriate response: Draconian measures to counter the anthropogenic global warming, notably by reducing carbon emission to the atmosphere, could have several negative security implications. Potential scenarios include increased emphasis on biofuels that decrease food security and increasing tariffs on trade and communication that reduce global economic activity and tourism and increase poverty. Too much emphasis on the dangers of climate change may also

Given the potential range and scope of consequences of climate change, it is not surprising that there is a concern about its security implications in these regions. Indeed, this began to surface soon after the Third Assessment Report (IPCC 2001) and has recently accelerated, even though the issue is peripheral even in the most recent IPCC assessment (IPCC 2007).

provide an excuse for autocratic regimes that refuse to take responsibility for the impact of their own policies. The resulting causal model from these hypothesized linkages (pictured in the schema) depicts a two stage process: first, whether climate change has adverse socio-political and economic effects on a given society, and second, whether any resulting negative consequence increases the baseline risk of armed conflict.

Besides the mediating effects of societal conditions on violence, we also believe that there are direct feedback effects from violence to land-use conditions and intensity, as well as to further migration (flight from conflict) and to the sense of insecurity/vulnerability of individuals living in the conflict zones. Additionally, there are indirect feedback effects from migration through increased population pressure in zones of safety and reduced density in zones of violence to land-use.

