The time is now to clean our home

By Professor Ravi Naidu

Contamination of Earth's critical zone – including the air we breathe, the water we drink, and the soil we use to grow food – by the chemical products and byproducts of human activity is one of the most pervasive and far-reaching impacts of human activity. Chemical contamination has reached all parts of the globe, from the equator to the poles, from cities to the most isolated forest regions, and from coastal shorelines to the deepest parts of the ocean. Chemical contaminants, made or distributed by humans, affect virtually everyone on the planet.

Toxic contaminants created by humans are now found in wild animals from the Artic to the Antarctic, in the blood of newborn children and in mothers' milk, in the home, in the workplace and in the food chain. There is mounting evidence that this pollution is moving rapidly around the planet, carried in air, water, wildlife, traded goods and people themselves.

There are estimated to be more than five million potentially contaminated sites worldwide[i], chiefly in or close to centres of population. The majority of these sites have never been cleaned up and pose ongoing risks. But contamination also exists far from major centres of human habitation, in areas where resource extraction or industrial activity occurs. In most if not all countries, humans are releasing hydrocarbons and other volatile chemicals, heavy metals, and persistent organic pollutants into the air. These contaminants then migrate around the globe and find their way into surface water and groundwater that is used for drinking, cooking and other household purposes by hundreds of millions of people.

In addition, some modern homes and offices emit toxic vapours that adversely affect their inhabitants on a daily basis. The sources of these substances include not only the chemical, oil and coal industries, but also mining, agriculture, construction, manufacturing, waste disposal and electronics.

Almost everything we either produce or consume has chemical consequences – and these have already spread around the globe.

We recognise that human achievements are great and have created a world that has become, for many, a more habitable and supportable environment, bringing prosperity, modern conveniences, advanced healthcare, and comfortable livelihoods. At the same time, hundreds of millions, if not billions, of people around the globe, in both developed and less developed nations, live in poverty and are subject to the chemical legacy of our industrial development.

Chemical contamination is one of the ten 'planetary boundaries', which, according to some of the world's most eminent scientists, humanity ought not to cross.[ii] The reasons are self-evident: a contaminated world is an unsafe world – for ourselves, for our children and for all forms of life. Even the most advanced nations will suffer, directly or indirectly, from pollution, whether the source is thousands of kilometres away or just down the street.

The risks of chemical contamination are not new. Pollution from fires and the mining of metals was known to the citizens of ancient Rome and Athens as well as the cities of the Middle Ages. It has been just over 50 years since Rachel Carson, in the seminal book *Silent Spring*, warned the world of the risks of pesticide contamination of the food chain and agricultural environment. Since then, many governments have established environmental protection agencies to try to limit the risk to society. Groups of concerned citizens and parents have formed around the world.

What's new is the sheer scale of the contamination and the rapidly accumulating medical evidence of adverse health consequences affecting millions of people the world over. Since Carson wrote *Silent Spring*, global pesticide use, for example, has grown by more than 30-fold and while some highly persistent

chemicals (e.g. DDT) have been withdrawn, they have been replaced by many new substances whose toxicology is as yet unclear. Per- and poly-fluoroalkyl substances (PFAS) provide a more recent example. These chemicals, with industrial uses spanning food packaging, waterproof fabrics, non-stick cookware and firefighting foams, are found in all environments – and indeed in almost all people – everywhere on Earth.

According to the United Nations Environment Programme (UNEP), between 2000 and 2017, the global chemical industry's production capacity almost doubled, from about 1.2 to 2.3 billion tonnes. During this period, although production growth remained constant in Europe and North America, developing economies, including China, the Middle East and India, experienced rapid annual growth of over 7 to nearly 12 per cent. Global growth is at almost 4 per cent.[iii] However, this constitutes only a tiny fraction of the combined chemical emissions from mining, agriculture, the burning of fossil fuels, manufacturing, cement and concrete production, the electronics sector, water treatment, pharmaceutical use, illicit drug making, weapons manufacture, and other activities. Yet this big picture of human chemical emissions is missing from the awareness of most of today's citizens, environmental regulatory agencies, investors and researchers.

Another aspect of growing concern is the *combined* impact of the 140,000-plus chemicals now in circulation. We know or suspect as many as a third of these chemicals to be toxic, to cause cancer, or to have genetic, hormonal and other impacts. Every day, the average citizen inhales, ingests or absorbs many hundreds or even thousands of such contaminants. Although, in most cases, the quantity ingested is miniscule, many of these pollutants accumulate in our blood and bodies, increasing the chance of damage over time.

Mixtures of chemicals can be particularly hazardous, compounding adverse health impacts. This issue is extraordinarily complex and has not been studied sufficiently to allow reasonable predictions of its effect on current and future generations of humans, not to mention life on Earth. Put simply, you may take in a toxic chemical in a dose too small to cause known harm – but what effect will it have in combination with the other several hundred substances you ingested that day, or the days, weeks, months and years prior?

In *State of the Science of Endocrine Disrupting Chemicals*, the UNEP and World Health Organization warned about the increasing global trend in hormone-related disorders seen in both people and wildlife. These include falling sperm counts in males, deformed genitals, and increases in the incidence of neurobehavioural disorders and hormone-related cancers. "The speed with which the increases in disease incidence have occurred in recent decades rules out genetic factors as the sole plausible explanation," the report stated.[iv]

The recent megafires seen in Australia, Brazil and the United States raise yet another issue. Such bushfires are themselves major sources of contamination. The burning process itself affects air, soil and water quality; firefighting suppressants and retardants contain chemicals that are potentially toxic or can disrupt the environment (e.g. by promoting harmful blue-green algal blooms); and when buildings and infrastructure burn down, they release pollutants into the environment. The debris left behind after a major fire – including animal carcasses and twisted metal – is also a potential environmental hazard. Climate change will make such fires more frequent and intense.

The warmer soil and extended drought associated with climate change also has consequences beyond increased fire activity. Climate change is increasing soil erosion, intensifying storms and, in some areas, delivering more extreme rainfall and flooding. These phenomena could increase our exposure to soil contaminants – including heavy metals and metalloids such as mercury, arsenic and lead, as well as PFAS – contained in airborne soil and dust, carried via floods or released from melting ice. Warmer conditions also increase the conversion of contaminants – such as methane, ammonia, nitrous oxide, sulfides and mercury – to vapour form, which can be dispersed on the wind. Furthermore, higher temperatures can increase the

toxicity of certain contaminants by increasing their bioavailability (a measure of how easily chemicals are taken up into our bodies or into micro-organisms, plants and animals – some of which we consume as food).

All the evidence now points towards a world increasingly flooded with emissions of human-made chemicals, whether produced deliberately or unintentionally as by-products of other processes. The carbon (and other substances) emitted when we burn fossil fuels is but part of this bigger picture. However, our knowledge of the full impact of all these emissions is currently at the same level as our knowledge of climate science in the 1970s: we know enough to be concerned, but we do not yet comprehend the deeper consequences. So far as global contamination is concerned, we remain in a state of blissful – and almost certainly dangerous – ignorance.

The World Summit on Sustainable Development in 2002 agreed that chemicals should be used and produced "in ways that do not lead to significant adverse effects on human health and the environment" and set a deadline of 2020 to achieve this goal. This pledge was reaffirmed at the Rio+20 Summit in Brazil in 2012. In reality, far too little is known for such a goal to be even remotely feasible (as admitted in the UNEP's 2019 Global Chemical Outlook II[iii]) – while the scientific evidence of harm continues to accumulate.

In the interests of the health and wellbeing of all present and future humans,

I am calling for a worldwide investigation and assessment of the scale and impact of the combined contamination unleashed by human activity on our own species and life on Earth.

To this end, I initiated and launched the globalCARE Alliance™ in 2013. The globalCARE Alliance will, with support from experts worldwide, build capacity and develop innovative approaches to help clean up contaminants in developing nations to minimise further contamination of the global environment. Given the extent and severity of existing contamination, we must also investigate the potential for and extent to which these contaminants also contribute to climate change. I am therefore inviting scientists and policy makers to support the establishment of a 'Contaminants Accord' similar to the Paris Agreement on climate change. I ask those keen to support this initiative to please insert their e-signature under the Contaminants Accord below, and send the document to ravi.naidu@crccare.com.

Ravi Naidu

Professor Ravi Naidu

Founding Director, The globalCARE Alliance™

Ravi Naidu is a Global Innovation Chair at the University of Newcastle, Australia, founding director of the university's Global Centre for Environmental Remediation, and managing director of Australia's Cooperative Research Centre for Contamination Assessment and Remediation of the Environment (CRC CARE). He is the leader of the globalCARE Alliance, a scientific initiative to define, quantify, set limits to, help clean up, and devise new ways to curb the growing impact of chemical contamination on human health and the environment.

CRCCARE | A safer, cleaner environmental future

CALL FOR A GLOBAL CONTAMINATION ACCORD

Leading international contamination experts have called for worldwide action to reduce the impact of human-made chemicals on human health and the environment.

Warning of expanding disease risks from the many tens of thousands of industrial chemicals now circulating the planet in air, water, soil, food, wildlife and consumer goods, some of the world's most eminent contamination scientists have endorsed a global effort to reduce the scope for harm.

Signatories to the call are scientists who support an international initiative to define contamination problems that have a serious impact on human health and the environment, identify effective and practical solutions, and share and implement them globally.

The initiative, named the globalCARE Alliance™, is a global coalition of scientists, industry and regulators that aims to understand, curb and clean up chemical emissions, which are causing major environmental and human health hazards around the world.

Contaminants affect every country, all societies and most individuals. It is estimated there are more than five million potentially contaminated sites worldwide, as well as accelerating contamination of air, water and food globally. Many of these chemical emissions are toxic: hundreds if not thousands are now being linked by science to cancer, heart disease, mental disorders, learning difficulties, obesity, infertility, arrested child development and other conditions. Contaminants also threaten our most sensitive microbial biota, and in turn disrupt biochemical cycles that stabilise climate change.

However, the full extent of the global distribution of chemicals and their effects on the health of the world population – and life on Earth in general – remain largely unknown.

While a handful of countries are pursuing excellent science to try to understand and solve the problem, the issue has to date had a strong national focus. This is, however, a global problem, and it needs a harmonised global approach along with a huge effort to share common knowledge about the risks and possible solutions or ways to clean up problem contaminants worldwide.

According to the United Nations Environment Programme, the global chemical industry's production capacity is now well beyond 2 billion tonnes, about a third of which is thought to be toxic or carcinogenic. In developing economies, including China, the Middle East and India, production is growing at rates of over 7 to nearly 12 per cent. Global growth is at almost 4 per cent.[iii]

The globalCARE Alliance is a worldwide knowledge network, performing new scientific research, aggregating and sharing existing knowledge, helping to develop and publicise novel assessment and clean-up technologies, advising governments and industry on ways to improve existing regulation or industry practices, training high-level experts, and sharing knowledge about ways to reduce human-made contamination in all facets of society and the natural environment.

To sign the Contamination Accord, please visit www.surveymonkey.com/r/GlobalContaminationAccord.

More information

Prof. Ravi Naidu, Managing Director, CRC CARE, +61 (0)8 8302 5041 or +61 407 720 257

Adam Barclay, Communication Director, CRC CARE, +61 (0)8 8302 3925 or +61 429 779 228

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[i] Burlakovs J & Vircavs M 2011 'Possible Applications of Soil Remediation Technologies in Latvia', *Environmental and Climate Technologies*, Vol. 7, Iss. 1, Riga Technical University, Riga.

[ii] Rockström *et al*. 2009 'A safe operating space for humanity', *Nature* 461.

[iii] UNEP 2019, *Global Chemicals Outlook II,* www.unenvironment.org/resources/report/global-chemicals-outlook-ii-legacies-innovative-solutions

[iv] Bergman A et al., *State of the Science of Endocrine Disrupting Chemicals 2012*, WHO/UNEP 2013.