The globalCARE Alliance

Leading the world in Contamination Assessment and Remediation of the Environment

A global research and capacity-building alliance addressing one of the most serious threats to our planet and our future

Background

Technological advances in the manufacture and use of chemicals have delivered enormous benefits to humanity. However, contamination by industrial chemicals and other by-products of human activity has pervasive and far-reaching impacts on the Earth and on our own health and wellbeing. Traces of contamination are now found from the stratosphere to the deep oceans, from pole to pole, in many forms of wildlife, in all modern societies, in the food chain, and in most individuals, including newborns.

It is estimated that there are over 5 million potentially contaminated sites worldwide, chiefly in urban areas, of which the vast majority are unremediated. According to the Blacksmith Institute, an international organisation that fights pollution problems in low- and middle-income countries, a mere 3000 sites pose a threat to nearly 100 million people.

Many sites are contaminated with hydrocarbons that release toxic volatiles that pose significant health risks for people in residential and commercial areas. In addition, modern homes and offices may themselves emit toxic vapours which harm their inhabitants every day. The World Health Organization reports that in 2012 almost 13 million people died as a result of living or working in an unhealthy environment, with air, water and soil pollution and chemical contaminant exposure among the leading factors. Around 7 million people died – one in eight of total global deaths – as a result of air pollution exposure alone. These numbers will only increase if fail to coordinate efforts to combat contamination on a global scale.

Rockstrom *et al.* (*Nature* 461, 2009) identified chemical contamination as one of the ten 'planetary boundaries' that humanity, for its own sake, ought not to transgress (see Fig 1). However, owing to a lack of data, they were unable to quantify the extent of global contamination, its effects or where to set the boundary.

In the argument of Rockstrom *et al.*, chemical contamination is as significant as climate change, nutrient pollution, biodiversity loss, or any other major impacts of human population growth and development upon human health and wellbeing and the Earth's biosphere. Furthermore, it is likely that the effects of chemical contamination on the biosphere are exacerbated by these other impacts.

The six main pathways

by which toxic substances now travel around the planet are:

1. water (rivers, lakes, groundwater, oceans and airborne droplets)
2. soil (and thence into crops, pastures, livestock and the food chain)
3. the atmosphere (as gases, dusts and aerosols)
4. people (most humans now carry a lifelong burden of contaminants)
5. trade of manufactured goods and food, both legal and illegal
6. wildlife, including birds, fish, animals, insects, plants and microbes.

The UN Environment Program estimates current world industrial chemical output at 20 million metric tonnes, about a third of which is thought to be toxic or carcinogenic. The European Union lists around 144,000 registered chemicals, and the US Toxic Substances Control Act Chemical Substance Inventory receives up to 1000 notices of newly manufactured or imported chemicals per year.

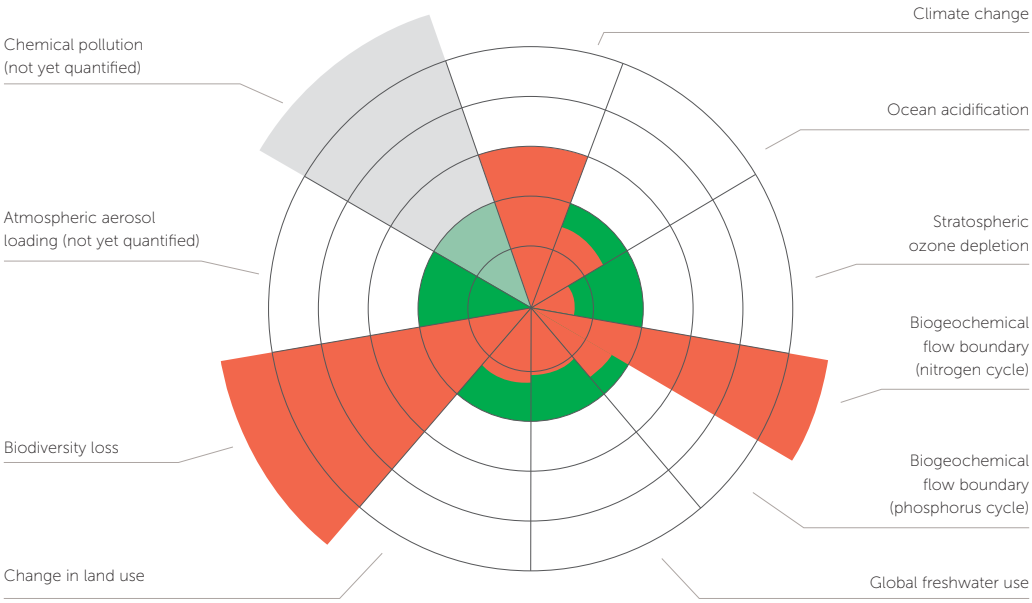

Figure 1. The ten planetary boundaries, including yet-to-be-quantified chemical pollution. Green shading represents the 'safe operating space'; red shading represents the current status of each boundary. Adapted from Rockstrom *et al.* (*Nature* 461, 2009).

In addition to manufactured chemicals, the mining, construction, farming and energy sectors release billions of tonnes of eroded soil, tailings and waste.

Much has been achieved by individual countries in defining the effects and limits for individual compounds or substances in food, drinking water, air and the human environment, as well as in the regulation of these. However, there remain significant gaps in our knowledge of the compounding effect of unintended chemical contamination on human health in particular and on biology generally, and of its growing dispersal throughout the Earth System.

Many manufacturing countries either lack effective regulations or do not enforce them, yet their products are traded globally. Even in the best-run jurisdictions, both knowledge and regulation still lag far behind the generation of novel chemical compounds, nano-products and electronic waste, and their release into the biosphere.

The rate of clean-up of polluted sites remains far below what is needed to protect environmental and human health. Furthermore, the worst-polluting industries are migrating rapidly into countries with weak or non-existent regulatory controls.

Earth System Science

A relatively new scientific discipline, Earth System Science aims to provide the knowledge needed to reach a balance between the needs of the people on Earth and the physical and biological limits of our planet. Intrinsic to this is the need to understand with precision exactly what the main human impacts are, any adverse consequences and, if so, how they may be best mitigated. Chemical contamination forms a very real and significant part of those impacts.

What is the globalCARE Alliance?

The globalCARE Alliance™ is a global 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 biosphere.

It is an international alliance of leading scientific, government, industry and community organisations and individuals dedicated to a cleaner, healthier and safer world through better approaches to contamination assessment and remediation of the environment.

The not-for-profit globalCARE initiative seeks not only to define the extent of contamination at international scales, but also to develop cost-effective, workable solutions that can be readily adopted by industry, governments and the community. These include further developing and disseminating the concepts of 'green production' and 'zero waste' – the production of goods and services without any accompanying risk of contamination.

The Alliance is a worldwide knowledge network that performs scientific research, aggregates existing knowledge, develops novel assessment and clean-up technologies. trains high-level experts, and shares information on how to reduce contamination in all facets of human society and the natural environment. It plays an advisory role, helping governments and industry improve existing regulation and practices.

Crucially, globalCARE works to raise the profile of this critical issue. A key reason that the fight against environmental contamination lags behind issues of similar (or lesser) importance is that it simply has not yet entered the public consciousness to a sufficient level.

The globalCARE Alliance brings together all stakeholders – from international and national decision-makers to affected communities – to develop the awareness and knowledge required to make genuine progress. Such a profile is required if we are to achieve a critical mass of policy, research and behaviour.

globalCARE forges important, and previously absent, linkages between human health and biodiversity protection. Biodiversity is a critical element of nature's clean-up processes. The healthier the Earth's biodiversity, the more capable it is of performing 'natural' remediation – in turn maintaining and improving its own health. This positive feedback loop has served the planet well for millennia, but in recent centuries human activity has interrupted this process to reverse the loop – the more polluted our environment becomes, the less able the planet is to clean itself up. As such, biodiversity must be protected from human activity, including chemical contamination.

Importantly, globalCARE also targets broadacre contamination, especially where it affects agricultural lands. This is an increasingly urgent issue, with several countries – most notably China – seeking solutions to the contamination crisis blighting many of its rural areas. Soil security is crucial; without it we face the prospect of countries fighting for farmland.

Above all, as its name suggests, globalCARE takes a global perspective, reaching far beyond the scale of individual contaminated sites. The initiative will seek to harmonise contamination policy and regulations worldwide. This is a bold goal, but a necessary one: pollution does not respect national borders.

Without international cooperation, it will be near impossible to manage and clean up contamination to the extent truly required.

The globalCARE Alliance is developing a 'stocks and flows' model of global contamination; seeking to establish safe emissions boundaries; prioritising the most urgent substances, issues and areas for action; investigating the combined effects of contamination on human health and the environment; and proposing and disseminating solutions.

One of globalCARE's most important features is the substantial value it adds to existing – but often piecemeal – efforts to overcome the contamination challenge. The initiative is in a unique position to assemble and resource international taskforces, including scientists, industry and regulators, to address global contamination problems and opportunities. The initiative both minimises duplication and maximises collaboration of research among (and within) countries, leading a global approach to a truly global problem.

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The problem and its context

Attempts to control pollution go back as far as the construction of the sewers of ancient Rome (600 BC) and early urban clean-air regulations in 13th century Britain. Research into the impact of industrial contamination is almost as old as industry itself, but today's scientific approach to the issue became established around 70 years ago.

In the ensuing decades, the research has focused on human health and environmental impacts of heavy metals and metalloids such as arsenic, mercury, lead and cadmium; toxic substances such as chlorine and bromine compounds; pesticides and volatiles (VOCs, POPs, PAHs, TCE, PBDE etc.); carcinogens such as benzene and other hydrocarbon products; and the movement and fate of these substances in the environment.

Modern contaminant science has raised awareness that pollution is rarely a simple effect caused by a single substance, but commonly involves a complex mix of hazardous chemicals and/or metals. These substances can circulate in the environment via ground and surface water, the atmosphere, dust and sediments, and they can concentrate in wildlife and the human food chain. Their effects can even pass from mother to infant. International awareness has been greatly enhanced by the World Health Organization and the Stockholm Convention (1995) with its 'dirty dozen' list of banned volatile chemicals.

However, it is thought that less than 1 per cent of the world's estimated 5 million potentially contaminated sites have been properly assessed or remediated – while humanity continues to produce and dispose of an estimated 400 million tonnes of hazardous waste each year, most of it unsafely.

Furthermore, the growing contamination scourge is an intergenerational issue. Many contaminants already damaging the environment and our health persist for years, if not decades. The more untested, unregulated chemicals that we produce (let alone those we already know are hazardous), the greater the problem we create for our children and the generations that will follow them.

It is for these reasons that the globalCARE Alliance considers that contamination is an issue at least as urgent as climate change, pandemic disease, ozone depletion, or any issue that profoundly affects human health, the safety of millions and the world ecosystem. Indeed, the many millions of deaths each year due to contamination dwarf those attributed to more prominent issues – for example, just over 2 million from cancer, 1 million from diabetes, and 1 million from HIV/AIDS. Despite this, contamination receives lower priority, both in terms of support for the science and in the development and implementation of public policy and practical solutions.

"Chemical contamination by humans, whether intended or not, is poisoning our environment. And not only does it threaten the health of our children and our families, but it also threatens industry, local economies, and productivity. It's an urgent problem that demands our attention, and I'm pleased that initiatives like globalCARE are committed to being an essential part of the solution. Under the leadership of Prof. Ravi Naidu, globalCARE is poised to bring together industry and regulators, along with the people, research, knowledge and data required to tackle chemical contamination on a planetary scale. I look forward to following globalCARE closely as it inspires global thinking and action to tackle a global issue." Senator Angus King, United States Senator for Maine

The reasons for this neglect of an issue so central to human and planetary health, safety and wellbeing include:

- A widespread lack of awareness among governments and societies about the current scale, pervasiveness and risk to billions of people from contamination of the Earth System.
- The complex nature of the threat, consisting as it does of more than 140,000 different synthetic chemicals and thousands more unintentional contaminants, with differing impacts on human and environmental health, whose interactions and synergies remain almost completely unresearched.
- The wide variation in regulation and enforcement between countries, and the reluctance of some industries to comply unless compelled to do so.
- The lack of clear market signals from consumers to industry to encourage the adoption of clean and safe technologies, products and processes.
- The multidisciplinary nature of assessment and clean-up, requiring the complex and costly teams of experts must be assembled to deal with a single site or issue.
- The fact that the production of new potentially hazardous substances far outruns the ability of regulators to assess and control them.
- Lack of scientific data on the genetic impacts of exposure to multiple contaminants, either short or long term.
- The very wide variance of standards and technical skills in dealing with contamination from country to country, and even within countries.
- Lack of effective control over the trade and transport of contaminated products, food and wastes.
- Continued disposal of contaminated waste into our oceans and other water bodies, where it can be recirculated in the biosphere and food chain.

The globalCARE Alliance's work is building national capacity – in countries at all levels of development – to not only remediate existing contaminated sites but also prevent contamination in the first place.

Become a globalCARE Member

The globalCARE Alliance is an international partnership involving governments, industry, scientific organisations and community bodies. An analogous body is the Stockholm International Water Institute. This partnership approach will strengthen networking and collaboration among scientists, regulators, engineers and industry managers. But it will also reach out to the community, to the consumers who influence demand for industry products, and to taxpayers who often pay for the consequences of pollution.

This recognises that the responsibility for cleaning up and preventing future contamination is society-wide, and does not depend on one group any more than another. It is a shared responsibility, and one we owe to future generations.

globalCARE invites organisations – whether research institutes, major corporations, small-to-medium businesses, or government agencies – to join as Members.

globalCARE Members are innovative organisations that recognise that we must do things differently. They are led by people who understand that, to a large extent, the global contamination problem is a result of rapid industrialisation at a time when humanity had insufficient knowledge of the potential consequences of unprecedented growth.

In more recent years, globalisation has compounded the issue by forcing the problem onto developing countries, where regulations can be weak or poorly enforced. The high cost of dealing with legacy contamination in more developed countries is simultaneously driving industrial activities to less developed regions. Wealthier countries – as both part of the problem and the owners of the resources required to solve it – thus have an ethical responsibility to play a major role in the solution.

Furthermore, the globalCARE Alliance's work is building national capacity – in countries at all levels of development – to not only remediate existing contaminated sites but also prevent contamination in the first place.

As well as gaining tangible benefit through the opportunity to expand their environmental and social credentials, Members will be exposed to new markets. Environmental consulting companies, for example, have the chance to work with world-leading researchers to develop technologies and then transfer them to companies that own and manage contaminated sites. The globalCARE Alliance's not-for-profit structure also has the potential to open up access to support from international aid organisations.

Perhaps most important, an association with globalCARE demonstrates a commitment to minimising contamination specifically, and stewardship of human health and the environment generally. This fosters confidence and trust among developing countries and major corporations, which in turn creates better – and more sustainable – business opportunities.

By committing to the globalCARE Alliance's mission, Members will:

- strengthen their credentials as environmental stewards
- help build capacity in developing countries
- foster innovative and sustainable business
- grow their access to global markets.

To find out more about becoming a globalCARE Member, email globalCARE@crccare.com.

Vision and goals

Our vision is to minimise the exposure of all humans and the Earth's biosphere to contamination from all sources

Goals

- Better understand the nature, extent, circulation and impact of contamination of the Earth System on human and environmental health and wellbeing.
- Assemble global data for international, national, industry and health bodies engaged in reducing the impact of contamination.
- Develop and assist the adoption of cost-effective technologies to assess and clean up or prevent contamination.
- Harmonisation of contamination policy and regulations worldwide.
- Share scientific knowledge and technologies for assessing, cleaning up and preventing contamination, locally and globally.
- Educate consumers, industry and governments about contamination, its pervasiveness, and its adverse effects and how to prevent them.
- Create value by developing beneficial uses for contaminated land.
- Prevent disease by fostering cleaner industry and contamination-free food.

globalCARE's founding director

Professor Ravi Naidu is the Chief Executive Officer and Managing Director of the Cooperative Research Centre for Contamination Assessment and Remediation of the Environment (CRC CARE) – a centre that he initiated. He is also Global Innovation Chair at the University of Newcastle (UON), Australia, and Director of UON's Global Centre for Environmental Remediation.

His work focuses on the remediation of contaminated soil, water and air, as well as the prevention of contamination. He also specialises in the potential impacts of contaminants upon environmental and human health at local, national and global levels.

As a leader in the move to a risk-based approach to managing contaminated sites, Prof. Naidu has helped pioneer a more rational, effective and affordable approach to contamination science and clean-up. He has also driven a shift to in-situ remediation – cleaning up contamination where it lies, rather than the traditional 'dig and dump' approach. In combination with Prof. Naidu's contributions to nationally harmonised contamination policy, these approaches save Australian industry many millions, if not billions, of dollars annually.

Through his teaching and mentorship, Prof. Naidu has helped foster the next generation of Australian clean-up scientists. He is an elected Fellow of the Soil Science Societies of America and New Zealand, the American Association for the Advancement of Science, the American Society of Agronomy, the Royal Australian Chemical Institute, the Royal Society of Chemistry, and the Australian Academy of Technological Sciences and Engineering. He is the current Chair of the International Committee on Bioavailability and Risk Assessment.

Prof. Naidu has authored or co-authored over 600 journal articles and 80 technical publications as well as 7 patents, and co-edited 11 books and over 66 book chapters in the field of soil and environmental sciences. has also supervised over 50 PhD completions. In 2013, he received an honorary Doctorate of Science from Tamil Nadu Agricultural University for "outstanding contributions to agriculture" and won the Richard Pratt – Banksia CEO Award at the Australian Banksia Sustainability Awards.

CRCCARE
A safer, cleaner environmental future

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