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A Philosopher Looks at The Impacts of Pollution on Health

Filozof o skutkach zanieczyszczeń dla zdrowia

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Abstract

This study of the impacts of pollution on health opens with discussion on the role of applied ethics when such issues are considered, which includes seeking clarity and presenting the case for ethical obligations at levels ranging from that of individuals via companies to governments and inter-governmental co-operation. This approach is then applied to issues of air pollution from nitrogen dioxide and particulates, as in my book *The Ethics of the Climate Crisis* (Attfield 2024), and then to issues surrounding microplastics, and other global issues of pollution (such as that of carbon monoxide). It is also applied to more local issues such as the impacts of desert sand on locations like Beijing, of photochemical smog on Los Angeles, and of chemical dumping on the coast of East Africa. Some ethical findings are also conveyed. Normative solutions considered for air pollution include the replacement of petrol- and diesel-powered vehicles with electric vehicles, and (meanwhile) the introduction of congestion charges and of zones that only vehicles with low emissions are allowed to enter. Solutions considered to counter plastic pollution include recycling schemes and public encouragement for plastics manufacturers to make use of alternatives to plastic. Generally, internationally agreed regulation is also needed.

Keywords

pollution, health, conceptual clarification, ethical analysis, SDG 3: Good Health and Well-Being, nitrogen dioxide, particulates, microplastics, low emissions, electric cars

Streszczenie

Niniejsze opracowanie poświęcone skutkom zanieczyszczeń dla zdrowia rozpoczyna się omówieniem roli etyki stosowanej w analizie tego typu problemów. Obejmuje to dążenie do precyzji pojęciowej oraz uzasadnienie obowiązków moralnych na różnych poziomach: od odpowiedzialności jednostek, poprzez przedsiębiorstwa, aż po rządy i współpracę międzyrządową. Tak zarysowane podejście zostaje następnie zastosowane do zagadnień zanieczyszczenia powietrza dwutlenkiem azotu i pyłami zawieszonymi, zgodnie z analizą przedstawioną w mojej książce *The Ethics of the Climate Crisis* (Attfield 2024), a dalej — do problemów związanych z mikroplastikiem oraz innymi globalnymi formami zanieczyszczeń (takimi jak tlenek węgla). Autor odnosi je również do kwestii bardziej lokalnych: wpływu pustynnego pyłu na obszary takie jak Pekin, oddziaływania smogu fotochemicznego w Los Angeles oraz skutków zrzutów substancji chemicznych u wybrzeży Afryki Wschodniej. W tekście przedstawiono także wybrane wnioski etyczne. Wśród rozwiązań normatywnych dotyczących zanieczyszczenia powietrza rozważane są: zastąpienie pojazdów zasilanych benzyną i olejem napędowym samochodami elektrycznymi oraz — w okresie przejściowym — wprowadzenie opłat za wjazd do stref zatłoczonych i tworzenie stref, do których mogą wjeżdżać wyłącznie pojazdy niskoemisyjne. W odniesieniu do zanieczyszczenia tworzywami sztucznymi analizowane są m.in. systemy recyklingu oraz działania publiczne zachęcające producentów do stosowania alternatyw dla plastiku. Podsumowując, konieczne są także międzynarodowe regulacje w tym względzie.

Słowa kluczowe

zanieczyszczenia, zdrowie, doprecyzowanie pojęć, analiza etyczna, SDG 3: Dobre zdrowie i jakość życia, dwutlenek azotu, pyły zawieszone, mikroplastik, niska emisja, samochody elektryczne

Introduction

The role of a philosopher who reflects on themes such as the impacts of pollution and health lies firstly in the clarification of the concepts involved, and secondly in eliciting and specifying the obligations that arise when such impacts come to human awareness. The philosopher's role could also be held to include expounding the aesthetic impacts of pollution, and thus reflecting on key concepts of aesthetics, in view of the related health impacts of

pollution on environments such as rivers, woods, parks and countryside; but this part of the philosopher's role must perforce be set aside for the present to make the scope of the present inquiry a feasible one.

1. Clarifying The Concepts

The concept of health (often understood as the capacity for normal functioning on the part of members of either humanity or another species) may seem unproblematic. But awareness is needed that the health of nonhuman animals and of plants is often at stake, just as that of humans is, in cases of pollution. Further, even if the fluctuating nature of ecosystems makes many philosophers sceptical about the notion of ecosystem health, nevertheless impacts on the relatively long-lasting local relations of soils, bacteria, funguses, insects, reptiles, birds and mammals (and thus what might reasonably be called "environmental health," but is sometimes called "environmental integrity": see Resnik 2012; Zölzer and Meskens 2017) often figure when the significance of impacts on health is being evaluated. This is because impacts on environments and habitats can affect the health both of humans and of other living creatures; see SDG 3: Good Health and Well-Being (UNDP 2015). So comprehensive studies of the impacts of pollution on health would in principle need to take this dimension into account, as well as more direct impacts. However, researching such wider impacts lies largely beyond the scope of the current essay, if it is to remain confined within reasonable limits.

Similarly, the concept of pollution is also less straight-forward than it may appear. It is widely agreed that by "pollution" people do not usually these days mean "ritual pollution," even though this is probably the original meaning of the term. As John Passmore writes, pollution is the process of putting matter in the wrong place, in quantities that are too large. Or, as he adds, doing this to matter or to physical processes, for there are such things as noise pollution and radiation pollution (Passmore 1974, 45), or, we might add, light pollution. But this definition, as Passmore goes on to say, raises without resolving the question of what is meant by "the wrong place."

As Passmore goes on to say, a place may be the wrong place if items placed there are

aesthetically displeasing, such as "oil in an estuary, soot on a building, or beer cans in a park" (his examples: Passmore 1974, 45)). And while tastes can differ, few people would enjoy swimming in a river polluted by sewage (again his example, but one that the more recent organisation "Swimmers Against Sewage" would heartily acknowledge). Secondly a place may be the wrong place when the presence of a substance or process in that place in two great a quantity (or intensity) is dangerous to human health, something directly relevant to the theme of this inquiry. Thirdly a place could be the wrong place if the presence of a substance or process there will destroy (or, we could add, blight or injure) wildlife, plants or animals (Passmore 1974, 46). Some of his earlier examples would serve well again, including those of oil in an estuary and soot on and around buildings; while beer cans in a park pose a threat of at least injury to humans and nonhuman animals alike. Passmore's list may not be exhaustive (thus human activity is also polluting outer space with debris from space missions of the past, even though neither humans nor other living creatures are impacted, nor usually their aesthetic sensitivities; but for present purposes his exposition of the concept of pollution appears more than adequate.

Passmore goes on to suggest that pollution is an ecological problem not because it is a scientific problem (although there are scientific problems involved in explaining particular kinds of pollution and how to reduce or prevent them), but because it is a social problem, raising normative issues about obligations either to prevent particular forms or to counteract them in whole of in part (Passmore 1974, 46-7). We might qualify this by noting that pollution is sometimes an inter-species problem rather than a social problem; but the same implications arise. Neither science nor technology can solve ecological problems because of this normative element, which unavoidably introduces ethical and political issues into the question for solutions for ecological problems such as that of pollution.

2. Specifying The Problems

There are many problems of pollution. They include light pollution, which prevents people having an adequate view of the stars, localised pollution from lead and from mercury,

each sometimes fatal, plastic pollution, often fatal to wildfowl and other marine creatures, and pollution from radioactive strontium-90, resulting from nuclear testing prior to the Nuclear Test Ban Treaty of 1963, but still present worldwide in rainfall. Some of these forms of pollution are now beyond human control, such as the presence of strontium-90 in rainfall, while others can either be eliminated or at least reduced (plastic pollution is a good example).

The task of delineating all the kinds of pollution is at least a book-length task, which could well require an encyclopaedia rather than a single book. In this essay, two generic kinds of pollution are considered, global pollution, and pollution that is local to specific countries or regions. The solutions or partial solutions to these problems are prone to be of different kinds, with the solution of global problems often requiring international collaboration, and the solution or mitigation of local or regional problems calling for effort or for legislation at a local or regional level.

There are two broad kinds of global problems. One kind is systemic, with planetary winds and currents distributing some kinds of pollution to everywhere or nearly everywhere on the planet, with the result that peoples who have contributed little or nothing to such problems suffer from them just as much as the countries of major polluters. Emissions of carbon dioxide are of this character, causing global warming and the extreme weather events that it generates to almost everywhere on earth. (Some might claim that carbon dioxide does not count as pollution because it is beneficial to plants, and thus is not a pollutant from their point of view, but because of the impacts of carbon dioxide emissions on temperatures and weather systems it readily complies with Passmore's definition of "pollution" (endorsed in section 2), and also harms or destroys many plants through these same impacts.)

The other kind of global problem is cumulative rather than systemic; pollution of this kind is locally caused and has mostly local impacts, but the problem is nevertheless global because noxious substances or processes are released in a growing number and range of places worldwide, and so (for example) all the world's major cities suffer from such pollution. Examples include the impacts of road traffic (impacts like emissions of nitrogen dioxide), with resulting pollution being found wherever there are petrol- or diesel-fuelled cars, although to

different levels of intensity in different places.

I have written elsewhere about globally systemic pollution in the form of emissions of carbon dioxide. This is probably the most important form of global pollution, and the form that threatens the most widespread and longest-lasting impacts (not least on health), in the form of sea-level rises and their effects, and increasingly intense and increasingly frequent extreme weather events (such as storms, floods and wildfires). Having written about this form of pollution in my recent book *The Ethics of the Climate Crisis* (Attfield 2024, 6-27), I will not discuss it further here.

That leaves globally cumulative problems of pollution, which are not confined to emissions of nitrogen dioxide, but include emissions of particulates (small and often invisible solid particles emitted from exhaust pipes and from the erosion of tyres), which are equally serious in causing pulmonary disease in human beings and in many other creatures (Harvey 2022). Another globally pervasive pollutant is the poisonous gas carbon monoxide, also arising from the exhausts of petrol-powered vehicles (and also from domestic gas stoves) (NASA Earth Observatory 2024). One further globally significant problem of pollution is pollution from plastic, which is discussed in greater detail below. The need for ways of mitigating these kinds of pollution will also be returned to below.

Yet relatively local forms of pollution are just as prone to have significant or serious impacts on human health. In this essay I will be discussing three examples, dust pollution affecting Beijing, photochemical smog affecting Los Angeles, and the dumping of chemicals, whether conventional or radioactive, on the east coast of Africa. There are many other kinds of localised pollution, but these are significant enough and diverse enough to warrant consideration here.

It remains true that there are places where many forms of pollution are present in the same place. Thus, it is said that the port-town of Onitsha (on the River Niger in Nigeria) is one of the most polluted places on earth, where pollution from carbon dioxide and methane is combined with plastic and chemical pollution, both on land, in the river and in the air (Egbedi 2017). Yet the various problems are best understood separately, even though they sometimes

coincide. The role of those appointed to minimise pollution in places where pollution is present in multiple kinds is much more difficult than elsewhere, but even to understand what the problems of these unfortunate people are, we need to look at the various different kinds of pollution on the basis of the merits (or rather the demerits) of each.

3. Desirable Solutions and Related Obligations

Most problems have multiple possible solutions; but it does not follow that either individuals or political authorities have obligations to put any of them into effect. For example, all road vehicles with tyres (whether petrol-powered or battery-powered) are capable of generating particulates, and thus one kind of air pollution; but it does not follow that all makers and users of such vehicles should cease making or using them, and that all relevant political authorities have obligations to ban their manufacture or their use. For the problem becomes a serious one when (for example) particulates are discharged by large numbers of vehicles into the same areas or along the same roads, while the problem can be much less serious in places where there are lower levels of traffic. Indeed, banning vehicles in areas such as these could constitute an unwarranted curtailment of people's freedom of movement and, relatedly, freedom of association.

Besides, there are other solutions. Road-use by vehicles can be limited either by requirements not to enter a certain zone, or by charging drivers who do so, or by schemes permitting one set of road users to enter such areas on odd-numbered days only and another set to enter the same areas on even-numbered days only. There again, particulate pollution could be limited by requiring fuels of certain standards and tyres of certain standards to be used, or, if this were feasible, for effective filtration devices to be fitted to vehicles to prevent the emission of particulates.

This example illustrates a number of salient themes. All pollution is liable to cause harm (whether to human beings or other species, or to both), but the extent of the harm needs to be weighed against the goods that the related activities make possible, and the balance of goods and harms compared with the relevant balances associated with alternative solutions. Only in

particular cases where the harms outstrip the goods should solutions be invoked, and even then, comparisons should be made between the costs and the benefits of different solutions, including ones based on voluntary abstention (e.g. from driving into certain zones) as well as ones based on public enforcement.

Mindful of such themes, various national, European and international bodies have attempted to specify levels of pollution, transgression of which would make particular areas (e.g. city-centres) or highways (e.g. trunk roads) unsafe, with a view to preventive measures being introduced to prevent such transgression (European Commission 2008; World Health Organization 2024). But it turns out that in some areas of cities and along some highways there are no satisfactory "safe" levels of air-pollution, however low the levels are set; for there are significant risks to human health (for example of pulmonary disease being generated or exacerbated) with almost any level among the people present on most working days (Fuller 2022, 2).

It is findings such as these that can justify schemes to charge all vehicles except those with ultra-low emissions for admission to certain congested zones. They can also justify obligations for drivers to comply with such schemes, or with yet stricter schemes forbidding entry to such congested zones.

4. Some Examples of Air Pollution and Related Solutions

Fiona Harvey cites the State of Global Air report as estimating that 1.7 million deaths that occurred in 2019 were due to exposure to airborne particulate matter, and took place in as many as 7,239 cities worldwide. Exposures were highest in South and East Asia, Africa and the Middle East. The same report relates that 92 per cent of the world human population lives in areas that exceed one of the World Health Organization's targets for exposure to particulates (Harvey 2022). (Diesel-powered cars are agreed to be a prolific source of particulates, but petrol-powered vehicles contribute significantly as well.)

The same author reveals that serious levels of nitrogen dioxide are blighting numerous cities in relatively prosperous countries. The world's worst cities for this kind of pollution are

Shanghai, Moscow, Tehran and St. Petersburg. Other seriously affected cities include Cairo, Istanbul and Ho Chi Minh City. In these various cities, traffic pollution, often from older fleets of vehicles, seems to be the main source of the problem (Harvey 2022).

But it is not only megacities that are affected; so are other cities, towns, and most arterial roads. The World Health Organization estimates that ambient (outdoor) air pollution in both cities and rural areas caused 4.2 million premature deaths worldwide in 2016, with some 91 per cent of these deaths occurring in low- and middle-income countries. It adds that (quite apart from outdoor pollution) indoor smoke (often including carbon monoxide) is a serious health risk for some 2.4 billion people who cook and heat their homes with biomass, kerosene fuels and coal (World Health Organization 2021). Meanwhile, in the United Kingdom, the Royal College of Physicians (RCP) estimated in 2017 that approximately 40,000 premature deaths and over 20,000 hospital admissions could be attributed to air pollution every year (Royal College of Physicians 2017).

The health impacts of emissions of nitrogen dioxide and of particulates have been evaluated as follows by DEFRA, the relevant Department of the British government. Nitrogen dioxide "irritates the airways of the lungs, increasing the symptoms of those suffering from lung diseases." As for particulates, "fine particles can be carried deep into the lungs, where they can cause inflammation and a worsening of heart and lung disease" (DEFRA 2022).

Just in case these kinds of harm and disease might seem tolerable, it is worth citing a study conducted by US researchers in Canada, one of the cleanest and least polluted countries on Earth. Despite the relatively clean air of Canada, this study found that nearly 8,000 Canadians were dying prematurely each year from outdoor air pollution, and that even in the cleanest areas people were experiencing an adverse impact on their health (Fuller 2022).

Fuller relates that two other reports (as well as the one about Canada), one on USA and the other on Europe, also concluded that there is no safe lower limit for air quality. Hence governments should not focus on setting targets, as if those levels of pollution would be acceptable, but should instead focus on continued reductions year by year into the indefinite future (Fuller 2022, 2). Fuller adds that air pollution has been found to contribute to dementia,

as well as to other health conditions (Fuller 2022).

Accordingly, the impacts of pollution on human health are serious enough to warrant the introduction of solutions (or partial solutions) on the part of local authorities and national governments. Thus, the introduction of universal or near-universal electricity supplies that could replace the use of biomass for cooking and heating could prevent some of the indoor deaths currently taking place in middle- or low-income countries.

Solutions to problems such as outdoor pollution from nitrogen dioxide and particulates include the introduction of electric cars, from which there are no emissions (although particulates could still be spread by their tyres.) This solution was considered by Passmore, who concluded (in 1974) that the need to replace millions of automobiles with electric vehicles lay beyond the bounds of feasibility, because of the prohibitive costs involved (Passmore 1974, 48-9). But this solution has now become much more feasible, partly through changes to the available technology and partly through economic factors. Accordingly, this solution is likely to play a significant role in mitigating the problem, over the course of the next two or three decades.

Meanwhile some of the solutions mentioned earlier could serve a bridging role, pending the replacement of petrol- and diesel-powered cars with electric ones. Thus, the Mayor of London's Ultra-Low Emissions Zone (ULEZ), which requires a charge of drivers entering a quite large area of central London and London boroughs, has been found to reduce levels of nitrogen dioxide in the same area, as well as reducing congestion (Greater London Authority 2025). And recently, New York City has been imposing a charge of nine dollars on vehicles entering Manhattan, and automobiles have been found to be moving 15 per cent faster; this is indirect evidence that emissions are likely to have been reduced as well (Wright 2025). (Nevertheless, the Trump administration is said to want to abolish this charge.) Solutions such as these are often initially unpopular but are likely at least to reduce the number of people whose health is seriously affected by vehicle emissions, and probably the number of deaths.

Such solutions are therefore to be recommended, at least for the areas worst affected by emissions. But they need to be supplemented by the production and use of better tyres, less

liable to spread particulates; and also, by widespread and more consistent efforts on the part of local authorities to reduce the number and the extent of potholes, which almost certainly contribute to particulates entering the air of cities and highways.

As for carbon monoxide, indoor pollution of this kind (from gas stoves and gas leaks) could be tackled by the introduction of carbon monoxide smoke alarms. Outdoor pollution of this kind warrants the eventual replacement of petrol-powered vehicles by electric ones, and meanwhile by the improvement of internal combustion engines so that less carbon monoxide is generated. Traffic restriction schemes could also have a part to play.

5. Some Examples of Plastic Pollution and Related Solutions

According to the campaigning body Client Earth, there are an estimated 171 trillion pieces of plastic in the oceans (ClientEarth 2025). This alarmingly high figure makes better sense when the nature and extent of microplastics are brought into the picture.

To cite a recent paper on plastic pollution, "microplastics are small plastic pieces less than five millimetres long which can be harmful to ocean, aquatic and human life. Plastic is everywhere. A lot of it ends up in the ocean. Most plastics in the ocean break up into very small particles. These small plastic bits are called 'microplastics'" (Kolkar et al. 2025). Such microplastics readily enter the oceanic food-chain, and thus eventually in some measure into the food on grocery shelves.

Besides, as the same authors relate, "Other plastics are intentionally designed to be small. They're called "microbeads" and are used in many health and beauty products" (Kolkar et al. 2025, abstract). Not surprisingly, both oceanic and airborne microplastics and also terrestrial microbeads find their way into human beings: "Human uptake of microplastic occurs via inhalation of airborne fibers and ingestion of microplastic-contaminated foods and beverages. Contamination of food can also stem from airborne deposition and the release of microplastic particles and fibers from clothing, production lines and packaging" (Kolkar et al. 2025, abstract). While much ingestion of microplastics is usually inadvertent on the part of consumers, microplastics turn out to be intentionally included in many brands of tea-bags.

The same authors attest that further chemicals are often added to endow the plastics in use with characteristics that the manufacturers aim for. Thus: "Additional chemicals are added to give the plastic particular characteristics. Some of these are carcinogens or endocrine disruptors such as bisphenol A and phthalates (plasticizers). Phthalates are associated with elevated blood pressure, obesity, [and] elevated levels of triglycerides. Bisphenol A (BPA) is associated with breast, prostate, ovarian, and endometrial cancers" (Kolkar et al. 2025, abstract). The health problems liable to arise become apparent without further elaboration. Yet microplastics were found in the blood of eighty per cent of people tested in a recent study (ClientEarth 2025).

To return to oceanic plastic, an estimated 300,000 whales, dolphins and porpoises die every year from discarded fishing gear, most of it made of plastic (ClientEarth 2025). The scale of this and related problems attendant on plastic pollution comes more clearly into focus when the rate of deposition is taken into account. According to National Geographic, eight million tons of plastic "escape" into the oceans, and microplastics have also spread around the entire planet so as to be found everywhere from Mount Everest, Earth's highest mountain, to the Mariana Trench, the planet's deepest oceanic trough. What is more, global production of plastics has increased from 2.3 million tons in 1950 to 448 million tons (annually) by 2015; it is expected to double (from 2019 levels) by 2050 (National Geographic 2019).

Currently, only 9 per cent of global plastic production is recycled. Meanwhile, nearly 2100 animal species are known to have been affected by plastic pollution (National Geographic 2019). Besides, much of what is produced is single-use plastic, the use of which may last for hours and minutes only, but which, unless recycled, will last in accumulating amounts for thousands of years (ClientEarth 2025).

Clearly more comprehensive recycling is one solution, together with campaigns to promote it, but, since the prospects of most plastic being recycled are (at best) limited, further solutions are needed to reduce the amount of plastic produced. Thus manufacturers should be encouraged to replace plastic (particularly single-use plastic) with paper or cardboard, or even, in some cases, with jute or with metal, and shops could be discouraged from wrapping items

such as fresh fruit with plastic, particularly when there is no need for wrapping at all. Waste management could be improved as so as to reduce the release of plastics into rivers, seas and oceans (National Geographic 2019). Also product design could be improved to avert the need for plastic wrapping, and the producers of plastic could be encouraged to produce substitutes instead of plastic for as many purposes as possible. These various solutions need to be tested, and their application entrusted to the ingenuity of relevant experts, as long as there is an underlying public policy mandate in that jurisdiction to reduce plastic use and replace plastic production to the greatest possible extent.

5.1. Regional Pollution: Air Pollution in Beijing

Pollution in and around Beijing (with its 21 million inhabitants) has involved both excessive nitrogen dioxide and unhealthy levels of particulates, together with pollution from ozone, sulphur dioxide and carbon monoxide, with these pollutants together generating unacceptable levels of smog. Many of the particulates are carried on the wind from nearby desert areas, although another large proportion have resulted from the city's traffic, as petrol- and diesel-powered vehicles have increasingly replaced bicycles (UNEP 2024).

Since emissions from conventional vehicles are one of the principal causes of local air pollution, electric vehicles are being introduced on a large scale, and public buses having become almost entirely electric-powered, while the renewed use of bicycles is also being encouraged. Recently, levels of sulphur dioxide have dropped sharply (UNEP 2024). But it is also likely to be necessary to curtail dust storms and wind-borne grains of dust. Possible ways of doing this involve attempts to stabilise nearby dunes and areas of desert and near-desert through planting drought-tolerant vegetation. The expertise of specialists in the regeneration and the forestry of arid regions is likely to need to be invoked before this regional source of air pollution can be sufficiently brought under control.

5.2. Regional Pollution: Photo-Chemical Smog in Los Angeles

The state of California has a mountainous terrain that traps pollution, and a warm climate that helps form ozone and other pollutants. In excessive quantities ozone is damaging

to the health of both humans and wildlife. Los Angeles has a bowl-like situation, causing a "pollution dome," making it one of the most polluted cities in the United States. The causes of this pollution are the activities of ports and particularly emissions from traffic. The phrase "Los Angeles smog" has become a widespread name for photochemical urban pollution in cities in general, but this term originates with the photochemical smog of this particular city, where it is difficult after dark to see the ground from high levels of hotels, or again the tops of high-rise buildings from the ground. Meanwhile the city's air pollution is known to harm the health of both humans and wildlife, often seriously (Airly 2025).

Attempts are being made to reduce this high degree of pollution, with controls on polluting vehicles and other schemes to curtail emissions, and thus to curtail secondary pollution in the form of ozone and particulates. Like many other cities, Los Angeles may be obliged to tax vehicles entering central areas of the city, and to restrict the movement of certain kinds of vehicles. Its distinctive terrain makes such measures even more likely to be needed here than in other cities with comparable levels of vehicle emissions.

5.3. Regional Pollution: Chemical Dumping in or Near Africa

There have been several episodes of the dumping of chemical wastes in or close to Africa over recent decades. Related narratives have been brought together by Professor Workineh Kelbessa, to whose research I am greatly indebted.

Thus in 1987 a Nigerian businessman allowed two Italian multinational companies to deposit and store 18,000 drums of hazardous waste materials, some of them radioactive, at the town of Koko. When the Nigerian authorities became aware of this dumping, they took steps to remove the drums. Meanwhile the town began to suffer long-lasting medical harms, including paralysis, premature births, brain damage and deaths (including that of the businessman who had permitted the project (Adeola 2001, 50).

Worse still were the impacts when waves from the Indonesian tsunami of 2004 struck and broke open several of the containers of toxic waste dumped close to 400 miles of the Somalian coastline in a period when there was no authority in Somalia to prevent such illegal

activities (probably in 1990-7). The health impacts ranged from respiratory infections, via abdominal haemorrhages, to sudden death after inhaling toxic substances. Subsequent localised cancer clusters have also been associated with these chemical discharges (Bridgland 2006). It appears that European companies bribed Somali warlords to allow this dumping. Italy began investigating this practice in 1997, but the worse health impacts did not take effect until the tsunami accidentally released the toxic materials late in 2004 (Kelbessa 2012).

A parallel case relates to Ivory Coast in West Africa. In 2006, several international and local bodies combined to dump 600 tonnes of caustic soda and petroleum waste at 18 open-air waste dumps at Abidjan, the country's commercial capital. This operation was co-ordinated by the Dutch company Trafigura, which hired the ship that transported the waste materials to Africa. This in turn led to 16 deaths and the medical treatment of 100,000 people. Subsequently Trafigura negotiated with the Ivorian government, which arranged for the waste materials to be removed (together with the soil and concrete it was resting on), and transported to France (Kelbessa 2012).

Tsunamis are admittedly unavoidable, and their impacts largely unpredictable, but dumping chemical substances on or near the coasts of developing and vulnerable countries is highly irresponsible behaviour, which should be prohibited in international maritime law. There should also be agreements for the companies of sea-faring countries to compensate individuals and communities whose health is adversely affected by maritime trade. The very fact that tsumanis are unavoidable and largely unpredictable should make commercial chemical dumping (in the literal sense) all the more strictly forbidden. There is no need for philosophers, despite their customary circumspection, to resile from such clearcut conclusions. A good example was set by Kelbessa when he selected and presented the above examples as cases of "Environmental Injustice in Africa" (Kelbessa 2012).

Conclusion

Attention to the concepts of pollution and of health, in the manner of philosophers, is well worth while when it brings to light the many varieties of pollution found in the modern

world, and the many kinds of damage to the health of human beings and of other creatures that pollution can facilitate, cause, or exacerbate. Reflection on solutions to problems of pollution, as pioneered by Passmore (Passmore 1974, 43-72), can serve to warn against adopting solutions that prove to be counterproductive, but also serves to elicit ever deeper solutions, as the underlying causes of the problems come to light. Thus, the chemical pollution of the Somali coast, while superficially due to an unexpected tsunami, was fundamentally due to the unjust and oppressive behaviour of large international companies in dumping toxic chemicals close to a vulnerable coastline.

Some of the worsening global problems such as pollution from vehicles and traffic and such as plastic pollution are going to require structural solutions across the coming decades, involving international agreements concerning the use of substandard tyres and, more importantly, of fossil fuels. Reaching such agreements needs to be treated as an urgent priority. Certainly, local problems warrant attention being paid to local factors and climates (such as those affecting Beijing and the different factors affecting Los Angeles), but their solution is likely to bring in wider (national or global) factors. When problems of pollution result from the structural weakness of a developing country, nothing but international agreement is likely to be able to offer solutions that will relieve such developing countries from forms of wanton oppression comparable to the worst excesses of colonialism.

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