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Additional sacrifice zones

Supplementary information to the report of the Special Rapporteur, David R. Boyd, on the issue of human rights obligations relating to the enjoyment of a safe, clean, healthy and sustainable environment

The following information is supplementary to the report of the Special Rapporteur on the issue of human rights obligations relating to the enjoyment of a safe, clean, healthy and sustainable environment (A/HRC/49/53). It is available on the website of the Office of the High Commissioner for Human Rights

https://www.ohchr.org/EN/Issues/Environment/SREnvironment/Pages/Annualreports.aspx

1. Due to a restrictive word limit, the following sacrifice zones could not be included in the main body of the Special Rapporteur's report on good practices in the implementation of the right to a safe, clean, healthy and sustainable environment (A/HRC/49/53). However, these sacrifice zones are important because they demonstrate the extent to which States and businesses are failing to fulfil their obligations and responsibilities, respectively, to protect people from exposure to pollution and toxic chemicals. Drawn from every continent and featuring more than 50 States, the additional sacrifice zones are intended to inspire all States and businesses to prioritize immediate action to improve environmental quality in these communities who are not only left behind but are in multiple ways the furthest behind. This Annex benefitted from the research efforts of a large number of contributors, whose names are listed in Appendix I.

2. To reiterate some essential information from A/HRC/49/53, some communities suffer from environmental injustices whereby the exposure to pollution and toxic substances is so extreme that they are described as "sacrifice zones".[1] The phrase originated in the cold war era, when it was used to describe areas rendered uninhabitable by nuclear experiments, conducted by the United States, the Soviet Union, France and the United Kingdom of Great Britain and Northern Ireland, that caused high and lasting levels of radiation.

3. Today, a sacrifice zone can be understood to be a place where residents suffer devastating physical and mental health consequences and human rights violations as a result of living in pollution hotspots and heavily contaminated areas. The most heavily polluting and hazardous facilities, including open-pit mines, smelters, petroleum refineries, chemical plants, coal-fired power stations, oil and gas fields, steel plants, garbage dumps and hazardous waste incinerators, as well as clusters of these facilities, tend to be located in close proximity to poor and marginalized communities. Global analysis indicates that 92% of pollution-related deaths occur in low-income and middle-income countries.[2]

4. The continued existence of sacrifice zones is a stain upon the collective conscience of humanity. Often created through the collusion of governments and businesses, sacrifice zones are the diametric opposite of sustainable development, harming the interests of present and future generations. The people who inhabit sacrifice zones are exploited, traumatized and stigmatized. They are too often treated as disposable, their voices ignored, their presence excluded from decision-making processes and their dignity and human rights trampled upon. Sacrifice zones exist in States rich and poor, North and South, as described in the examples below.

Africa

5. One of the regions suffering terrible air quality over a period of decades is Mpumalanga in South Africa.[3] Pollution from coal mining and coal-fired power plants is causing cancer, heart disease and respiratory illnesses, leading to high levels of premature mortality in townships such as eMbalenhle. Children are being particularly affected, violating their rights to life, education and a clean, healthy and sustainable environment. Air quality standards in South Africa are weak and, worse yet, not enforced as illustrated by regular exceedances in Mpumalanga. There are no consequences for the polluters. South Africa's public electricity supply company, Eskom, operates 12 coal-fired power stations in the Mpumalanga province. In 2015, the Department of Environmental Affairs granted Eskom delays to reach even its weak air quality standards for 11 stations.[4] In June 2019, Groundwork

[1] See Steve Lerner, *Sacrifice Zones: The Front Lines of Toxic Chemical Exposure in the United States* (Cambridge, Massachusetts, MIT Press, 2010).

[2] See Philip J. Landrigan and others, "The *Lancet* Commission on pollution and health", *The Lancet*, vol. 391, No. 10119 (February 2018).

[3] Maya, M, Musekiwa, C, Mthembi1, P, et al. (2015). "Remote sensing and geochemistry techniques for the assessment of coal mining pollution, Emalahleni (Witbank), Mpumalanga." *South African Journal of Geomatics* 4(2): 174–188.

[4] Republic of South Africa. (2015). Briefing by the Department of Environmental Affairs – applications for postponement to comply with minimum emissions standards by industry. Portfolio Committee Memo. Department of Environmental Affairs.

Trust and Vukani Environmental Justice Movement in Action filed a lawsuit in South Africa's High Court, based on the constitutional right to a healthy environment, seeking long overdue improvements in air quality.[5] A decision in the case is pending.

6. Equatorial Guinea, an upper middle-income nation, is one of the wealthiest States in Africa because of the extraction of oil, discovered in 1991. At the same time, Equatorial Guinea is also the most unequal nation in Africa, with high levels of extreme poverty. Unfortunately, air and water quality are very poor despite the nation's wealth. According to reports, most "Equatoguineans live with sporadic electricity, endemic typhoid and malaria, and without potable running water in their homes."[6] Annual exposure to fine particulate matter exceeds 50 micrograms per cubic meter and Malabo, the capital, is described as "severely polluted."[7]

7. Agbogbloshie is a notorious electronic waste (e-waste) scrapyard in Accra, Ghana's capital city. Thousands of workers collect, dismantle, and burn electronic equipment to access valuable materials, including gold, silver, copper, brass, iron, and steel. Soil, water, and air in Agbogbloshie are highly polluted because the extraction process releases large amounts of toxic chemicals, such as polybrominated diphenyl ethers (PBDEs), polychlorinated biphenyls (PCBs), chlorinated paraffins, lead, chromium, cadmium, zinc, nickel, and mercury.[8] Soil samples at Agbogbloshie contain extraordinarily high concentrations of persistent organic pollutants (POPs), including dioxins, furans, and PCBs.[9] Workers at Agbogbloshie are generally disadvantaged persons, including migrants from the rural areas of northern Ghana and members of ethnic minority groups.[10]

8. On a brighter note, in 2016, Ghana passed the Hazardous and Electronic Waste Control and Management Act (Act 917) and the Hazardous and Electronic Waste Control and Management Regulations (LI 2250). Producers and importers are now required to register with the Environmental Protection Agency and pay an eco-tax for imported electronics. The "E-MAGIN Ghana" project, which is largely funded by the European Union, was launched in 2018 to help implement Act 917 and LI 2250 through an integrated multi-stakeholder approach. In 2019, a partnership between the German Federal Ministry for Economic Cooperation and Development and Ghana's Ministry of Environment, Science, Technology and Innovation resulted in the opening of a technical training centre and a health clinic.

9. Pollution from the Lega Dembi gold mine in Ethiopia has harmed the health of thousands of people by exposing them to dangerous levels of cyanide, arsenic and mercury. For example, mercury levels in the mine's tailings ponds were nearly 500 times WHO guidelines, while arsenic levels were ten times higher than WHO guidelines.[11] Mothers and children are particularly affected by high rates of miscarriage, stillbirth, infant mortality, birth

[5] *Groundwork Trust and Vukani Environmental Justice Alliance Movement in Action v The Minister of Environmental Affairs*. (2019). Notice of Motion. High Court of South Africa, Gauteng Division, Pretoria.

[6] Hannah C. Appel, "Walls and White Elephants: Oil extraction, responsibility and infrastructural violence in Equatorial Guinea," *Ethnography*, 2012, 13,4: 439-465.

[7] M.E. Emetere and S.A. Sanni, 2018, "Air Pollution, A Case Study: Malabo, Equatorial Guinea," *AIP Conference Proceedings* 2043, 020026.

[8] C. Moeckela et al. "Soil Pollution at a Major West African E-Waste Recycling Site: Contamination Pathways and Implications for Potential Mitigation Strategies." *Environ Int.* 2020 Apr;137:105563. doi: 10.1016/j.envint.2020.105563. Epub 2020 Feb 25. PMID: 32106045.

[9] J.N. Hogarh et al. "Source Characterization and Risk of Exposure to Atmospheric Polychlorinated Biphenyls (PCBs) in Ghana." *Environ Sci Pollut Res Int.* 2018 Jun;25(17):16316-16324. doi: 10.1007/s11356-018-2090-3. Epub 2018 Apr 29. PMID: 29705902.

[10] D. Fischer et al., "Health Consequences for E-Waste Workers and Bystanders-A Comparative Cross-Sectional Study." *Int J Environ Res Public Health*. 2020 Feb 27;17(5):1534. doi: 10.3390/ijerph17051534. PMID: 32120921; PMCID: PMC7084368.

[11] Center for International Human Rights (CIHR) of Northwestern University's Pritzker School of Law, 2019. Urgent appeal relating to the decision of the Government of Ethiopia (GOE) to allow the imminent reopening of the Lega Dembi gold mine, Submitted to United Nations Special Rapporteurs and the Working Group on business and human rights. Available at: https://wwws.law.northwestern.edu/legalclinic/humanrights/documents/urgent-appeal-to-special-procedures-regarding-ethiopias-lega-dembi-gold-mine2.pdf

defects, and childhood disabilities.[12] Many people are afflicted with other chronic and debilitating illnesses. It was reported that mine employees "do not buy livestock products from the community in suspicion of the safety of the livestock in the vicinity of the company as the area is environmentally polluted with toxic waste from the mine."[13] For the Indigenous Guji Oromo peoples of Ethiopia, whose way of life has been agro-pastoral for centuries, water pollution from the mine has harmed and killed livestock and reduced crop yields.[14] An elder said that because of the mine, "we faced many problems: our cattle died after drinking water from the tailing dams, women lost pregnancy [miscarriage] and children have been disabled."[15] The mine was closed in 2018 due to concerns about environmental and social impacts, but discussions are ongoing about re-opening the mine.[16]

10. A copper smelter in Tsumeb, Namibia has discharged arsenic, copper and lead into the environment for decades, resulting in one in five residents having elevated blood lead levels and one in six residents having elevated arsenic levels.[17] Children are at risk of unhealthy exposures to arsenic and copper, largely from dust caused by smelter emissions, raising the risk of cancer and other illnesses.[18]

11. The Thar Jath oilfield in South Sudan has been ravaged by civil war and neglect, resulting in oil contamination of streams, groundwater and wells. The water is polluted with dangerous levels of heavy metals, including lead and barium, and these toxic substances are accumulating in the bodies of local people, as proven by hair samples.[19] Residents near the oil fields have experienced extensive gastro-intestinal illnesses, premature births, and birth defects. According to scholars, "There is a perceptible fear that rather than being the source of life, these water systems have become sources of misery, disease and death."[20]

12. More than half the world's cobalt, an essential component of lithium-ion batteries for electric vehicles, comes from the Democratic Republic of Congo, with a substantial proportion (estimated at 15-20%) being extracted by artisanal miners. Both industrial and artisanal cobalt mining lead to high levels of pollution.[21] The Kasulo district of the city of

[12] Olkeba Jima, Abdisa (2020). "The Socioeconomic Effects of Large-Scale Gold Mining on Local Community in Ethiopia: Empirical Evidence from Lega Dembi Gold Mining Company." *Journal of Indigenous Knowledge and Development Studies 1*(2).

[13] Regassa, Asebe (2021). "Frontiers of Extraction and Contestation: dispossession, exclusion and local resistance against MIDROC Lega-Dambi Gold Mine, southern Ethiopia." *The Extractive Industries and Society;* 100980. Available at https://www.sciencedirect.com/science/article/pii/S2214790X21001519.

[14] Center for International Human Rights (CIHR) of Northwestern University's Pritzker School of Law. 2020. *Ethiopia's Violations of Civil and Political Rights in connection with the Lega Dembi Gold Mine Submitted for consideration at the 130th Session of the Human Rights Committee.* Available at: https://tbinternet.ohchr.org/Treaties/CCPR/Shared%20Documents/ETH/INT_CCPR_ICO_ETH_42868_E.pdf

[15] Regassa, Asebe (2021). "Frontiers of Extraction and Contestation: dispossession, exclusion and local resistance against MIDROC Lega-Dambi Gold Mine, southern Ethiopia." *The Extractive Industries and Society;* 100980. Available at https://www.sciencedirect.com/science/article/pii/S2214790X21001519.

[16] Regassa, Asebe (2021). "Frontiers of Extraction and Contestation: dispossession, exclusion and local resistance against MIDROC Lega-Dambi Gold Mine, southern Ethiopia." *The Extractive Industries and Society;* 100980. Available at https://www.sciencedirect.com/science/article/pii/S2214790X21001519.

[17] Mapani, B. S., Uugulu, S., Hahn, R. L., Ellmies, R., Mwananawa, N., Amaambo, W., & Schneider, G. (2011). "Results of urine and blood from residents around the Copper Smelter Complex, Tsumeb, Namibia: An example of anthropogenic contamination." *MINING AND THE ENVIRONMENT IN AFRICA*, 48.

[18] Fry KL, Wheeler CA, Gillings MM, Flegal AR, Taylor MP. "Anthropogenic contamination of residential environments from smelter As, Cu and Pb emissions: Implications for human health." *Environ Pollut.* 2020 Jul; 262: 114235.

[19] Pragst F, Stieglitz K, Runge H, Runow KD, Quig D, Osborne R, Runge C, Ariki J. 2017, "High concentrations of lead and barium in hair of the rural population caused by water pollution in the Thar Jath oilfields in South Sudan." *Forensic Sci Int.* 274:99-106.

[20] Simon Garang Kuch & Jean Pierre Bavumiragira. 2019. "Impacts of crude oil exploration and production on environment and its implication on human health: South Sudan Review*". International Journal of Scientific and Research Publications (IJSRP)* 9,4: 247-56 at 251.

[21] Banza CLN, et al. "High human exposure to cobalt and other metals in Katanga, a mining area of the Democratic Republic of Congo." *Environ Res.* 2009; 109:745–752.

Kolwezi is located near industrial cobalt mines and was home to extensive artisanal cobalt mining until residents were forcibly relocated and their land sold to a Chinese mining company. A biomonitoring study found that the bodies of residents of Kasulo, especially children, were heavily contaminated by cobalt.[22] Children's urinary cobalt levels were more than a dozen times higher the safe level for miners established in the United States. Dust was the main pathway of exposure. High doses of cobalt can affect the heart, lungs, blood and thyroid. In addition, DNA damage among children points to elevated cancer risks later in life. Miners often work without basic protective equipment and experience dangerous exposure to dust, chemicals, and potential mine tunnel collapse.[23]

13. In 2007, Metal Refinery EPZ Ltd. established a lead battery and recycling facility in the Owino Uhuru neighbourhood of Mombasa, an area designated as an "export processing zone". The factory opened without the required Environmental Impact Assessment, and violated environmental regulations during its operational history.[24] Toxic discharges containing lead contaminated air, water and soil causing the lead poisoning of hundreds of children and adults. A 2015 study of 65 Owino Uhuru children determined that 45 participants had blood lead levels (BLLs) greater or equal to 5 µg/dL, including 16 with BLLs of 10–19.9 µg/dL and 4 with BLLs of 20–31 µg/ dL.[25] For comparison, the World Health Organization maintains that there is no safe exposure to lead and even blood lead levels as low as 5 µg/dL can cause decreased intelligence, behavioural difficulties, and learning problems for children.[26] Adverse health effects of lead exposure include learning difficulties, cognitive defects, high blood pressure, kidney failure, respiratory illness, reduced fertility, miscarriages, birth deformities, premature births and premature deaths. A 2015 task force report determined that "[l]ittle consideration was given to the safety and health of both the factory workers, residents of Owino-Uhuru and other neighbours to the factory, and environmental conservation".[27]

14. An inspiring community effort led by Goldman Prize winner Phyllis Omido and her organization called the Center for Justice Governance and Environmental Action resulted in the closure of the lead smelter in 2014. Nine residents of Owino Uhuru and the Center for Justice Governance and Environmental Action filed a lawsuit asserting that human rights, including the rights to health and a healthy environment had been violated. In 2020, the Land and Environment Court at Mombasa ruled in favour of the Owino Uhuru residents, determining that their right to a healthy environment had been violated, awarding 1.3 billion Kenyan shillings (roughly $13 million USD) in damages and ordering the defendants to clean-up the soil, water, and waste within four months.[28] The case earned international attention and the Office of the United Nations High Commissioner for Human Rights referred

[22] Banza Lubaba Nkulu C, Casas L, Haufroid V, De Putter T, Saenen ND, Kayembe-Kitenge T, Musa Obadia P, Kyanika Wa Mukoma D, Lunda Ilunga JM, Nawrot TS, Luboya Numbi O, Smolders E, Nemery B. "Sustainability of artisanal mining of cobalt in DR Congo." *Nat Sustain.* 2018 Sep; 1(9): 495-504.

[23] Williams JT, Mambu Vangu A, Balu Mabiala H, Bambi Mangungulu H, Tissingh EK. "Toxicity in the supply chain: cobalt, orthopaedics, and the Democratic Republic of the Congo." *Lancet Planet Health*. 2021 Jun; 5(6): e327-e328.

[24] Judgment (2020), Republic of Kenya, In the Environment and Land Court at Mombasa, Petition No. 1 of 2016, https://media.business-humanrights.org/media/documents/files/documents/Judgment_0.pdf.

[25] N.A. Etiang et al. "Environmental Assessment and Blood Lead Levels of Children in Owino Uhuru and Bangladesh Settlements in Kenya." *Journal of Health & Pollution* vol. 8,18 180605. June 11, 2018, doi:10.5696/2156-9614-8.18.180605.

[26] World Health Organization (WHO), no date, "Lead Poisoning and Health," https://www.who.int/news-room/fact-sheets/detail/lead-poisoning-and-health.

[27] Task Force on Decommissioning Remediation Strategy for the Metal Refinery EPZ Ltd in Mombasa, "Draft Report of the Task Force" (2015), https://centerforjgea.com/reports/OwinoUhuruParliamentaryTaskforcereport.pdf.

[28] *KM & 9 others v Attorney General & 7 others* [2020] eKLR (Environment and Land Court) <http://kenyalaw.org/caselaw/ cases/view/198619/>.

to its outcome as a "positive milestone for environmental justice".[29] However, the judgment has been appealed.[30]

15. The Anosy region in Madagascar is one of the most biodiverse areas in the world, with unique forests and high rates of endemic species, including the well-known lemurs. In 2006, Rio Tinto partnered with the Malagasy government to establish an ilmenite mine in the region (ilmenite is a mineral that contains titanium oxide, used in myriad consumer products). This operation "has been harshly criticized by Malagasy and international environmentalists and human rights activists for basic rights violations, exclusions and violence, and of executing a 'double land grab' – one for mining activities and one for spatially separate biodiversity offsetting – causing economic and physical displacement of Malagasy farmers, pastoralists and fishers."[31] The mine has damaged forests and contaminated water with toxic substances. Downstream from the mine, uranium levels are 350 times higher than the local average, while lead levels are ten times higher.[32] These heavy metals are known to cause organ damage and developmental delays in children. The loss of forests has affected residents' ability to hunt and grow manioc, their staple food source.

16. In Togo there are health and environmental impacts from phosphate mining and processing in the southeastern communities of Kpémé, Hahotoé, and Kpogamé. The processing plant in Kpémé discharges toxic waste containing lead, cadmium and fluoride into the air, water and soil, resulting in contaminated food, water and dust and elevated exposures for people living nearby. Recent research confirms that exposure to contaminants from the phosphate processing plant in Kpémé is contributing to cardiovascular dysfunction as well as kidney and liver damage.[33] There are confirmed cases of dental fluorosis in children (mottled and yellowish teeth) caused by the consumption of contaminated water and seafood as well as by the inhalation of phosphorite dust.[34]

Asia Pacific

17. In Jharia, India, fires burning in underground coal mines for a century continue to cause elevated levels of air pollution. Experts describe the air quality as "very poor", "severely polluted" and "critically polluted" because of coal mining and underground coal

[29] Office of the High Commissioner for Human Rights, "Court Ruling Called a Milestone in Environmental Justice," (Sept. 7, 2020), https://www.ohchr.org/EN/NewsEvents/Pages/LeadPollutionJudgement.aspx.

[30] Rosemary Mwanza, 2020, "Toxic Spaces, Community Voices, and the Promise of Environmental Human Rights: Lessons on the Owino Uhuru Pollution Incident in Kenya," *Nordic Journal of Human Rights*, 38:4, 279-304.

[31] Amber Huff, Yvonne Orengo, "Resource warfare, pacification and the spectacle of 'green' development: Logics of violence in engineering extraction in southern Madagascar", *Political Geography*, Volume 81, 2020, 102195. See https://www.sciencedirect.com/science/article/pii/S0962629819301532

[32] Helen Reid, "Water around Rio Tinto's Madagascar mine is high in lead, uranium: study," *Reuters,* December 20, 2019, https://www.reuters.com/article/us-rio-tinto-madagascar-idUSKBN1YO131

[33] Melila M, Rajendran R, Lumo AK, Arumugam G, Kpemissi M, Sadikou A, Lazar G, Amouzou K. "Cardiovascular dysfunction and oxidative stress following human contamination by fluoride along with environmental xenobiotics (Cd & Pb) in the phosphate treatment area of Togo, West Africa." *J Trace Elem Med Biol.* 2019 56:13-20. Melila M, Rajaram R, Ganeshkumar A, Kpemissi M, Pakoussi T, Agbere S, Lazar IM, Lazar G, Amouzou K, Paray BA, Gulnaz A. "Assessment of renal and hepatic dysfunction by co-exposure to toxic metals (Cd, Pb) and fluoride in people living nearby an industrial zone." *J Trace Elem Med Biol.* 2022 69:126890.

[34] Tanouayi G, Gnandi K, Ouro-Sama K, Aduayi-Akue AA, Ahoudi H, Nyametso Y, Solitoke HD. "Distribution of Fluoride in the Phosphorite Mining Area of Hahotoe-Kpogame (Togo)." *J Health Pollut.* 2016 Jun 16;6(10):84-94. See also https://www.ajol.info/index.php/jrsul/article/view/52222

fires.[35] The underground fires also cause subsidence (collapse of surface land), leading to deaths and loss of homes.[36]

18. During the Soviet era, there was extensive pollution in the city of Sumgait, Azerbaijan from mining, oil and gas extraction and chemical production.[37] Sumgait was identified not only as one of the most contaminated places in Azerbaijan but one of the most polluted places on Earth.[38] Residents suffer from high levels of lung cancer and breast cancer.[39] A remediation project financed by the European Commission cleaned up a site that was contaminated with benzo(a)pyrene, benzene, and polychlorinated biphenyls (PCBs), among other toxic substances. Contaminated soil was removed and replaced with clean soil and fertilizers, followed by the planting of 1,200 trees native to the region. The area is now a public park located near a beach.[40]

19. Ahvaz, Iran ranks as one of the most polluted cities of the world in terms of particulate matter concentrations. Annual concentrations are many times higher than the guidelines established by the World Health Organization for good air quality.[41] Exposure to these excessively high levels of particulates causes heart disease, stroke, respiratory illnesses and cancer, leading to thousands of premature mortalities in Ahvaz every year.[42] Poor air quality in Ahvaz is also linked to premature births and low birth weight.[43]

20. Air quality in Jakarta, Indonesia, is among the worst in the world's capital cities. Emissions from coal-fired power plants and motor vehicles create significant health risks to its residents, causing an estimated 7,390 deaths each year.[44] Covid-19 has exacerbated this already grim picture. An American study found that a 1μg/m³ increase in $PM_{2.5}$ was "associated with an 8% increase in Covid-19 death rate".[45] The Government of Indonesia and the Province of Jakarta have both made efforts to reduce air pollution in Jakarta including ambient air quality standards, emissions regulations and monitoring requirements for industries, investments in renewable energy, and efforts to curb open waste burning and forest clearing. However, a lack of implementation and enforcement has limited the

[35] Mondal S, Singh G, Jain MK. "Spatio-temporal variation of air pollutants around the coal mining areas of Jharia Coalfield, India." *Environ Monit Assess.* 2020 May 30;192(6):405.

[36] Vamshi Karanam, Mahdi Motagh, Shagun Garg, Kamal Jain, 2021, "Multi-sensor remote sensing analysis of coal fire induced land subsidence in Jharia Coalfields, Jharkhand, India", *International Journal of Applied Earth Observation and Geoinformation,* 102:102439.

[37] Submission from Azerbaijan. See also Shelton N. "Azerbaijan: environmental conditions and outlook." *Ambio.* 2003 Jun; 32(4): 302-6.

[38] B. Walsh, "The World's Most Polluted Places," *Time Magazine*, Sept 12, 2007.

[39] Soltanov AA. "Geographic spreading of lung cancer in Azerbaijan." *Georgian Med News.* 2009 Jan; (166): 94-8. Vatankha SS. "Epidemiological aspects of breast cancer in women in major cities of Azerbaijan Republic." *Georgian Med News.* 2011 Feb; (191): 18-22.

[40] P. Sharov, R. Abbasov and A. Temnikova, 2019, "Remediation of soil contaimniated with persistent organic pollutants, Sumgait, Azerbaijan," *Environ Monit Assess* 191, 7: 464.

[41] Khaefi M, Geravandi S, Hassani G, Yari AR, Soltani F, Dobaradaran S, Moogahi S, Mohammadi MJ, Mahboubi M, Alavi N (2017) "Association of particulate matter impact on prevalence of chronic obstructive pulmonary disease in Ahvaz, southwest Iran during 2009–2013." *Aerosol Air Qual Res* 17(1):230–237.

[42] Dastoorpoor M, Sekhavatpour Z, Masoumi K, Mohammadi MJ, Aghababaeian H, Khanjani N, Hashemzadeh B, Vahedian M. "Air pollution and hospital admissions for cardiovascular diseases in Ahvaz, Iran." *Sci Total Environ.* 2019 Feb 20; 652: 1318-1330.

[43] Sarizadeh R, Dastoorpoor M, Goudarzi G, Simbar M. "The Association Between Air Pollution and Low Birth Weight and Preterm Labor in Ahvaz, Iran." *Int J Womens Health*. 2020 May 4;12: 313-325.

[44] M. Santoso, D.D. Lestiana, E. Damastuti et al, 2020, "Long term characteristics of atmospheric particulate matter and compositions in Jakarta, Indonesia." *Atmospheric Pollution Research* 11(12), 2215-2225. doi:10.1016/j.apr.2020.09.006. S. Roy, 2019, "Dozens of People Are Suing the Indonesian Government Over Severe Air Pollution." *Global Citizen*. https://www.globalcitizen.org/en/content/jakarta-residents-sue-government-for-air-pollution/

[45] Wu X, Nethery RC, Sabath BM, Braun D, Dominici F., 2020, "Exposure to air pollution and COVID-19 mortality in the United States: A nationwide cross-sectional study." Preprint. *medRxiv*. 2020;2020.04.05.20054502. Published 2020 Apr 7. doi:10.1101/2020.04.05.20054502.

effectiveness of these measures.[46] In 2021, following a lawsuit brought by local residents, an Indonesian court found a violation of the right to clean air and ordered governments to take immediate action to improve air quality in Jakarta.[47]

21. Pollution affecting communities near the massive Karachaganak oil field in Kazakhstan has been a concern for many decades.[48] Residents of Berezovka complained about gas flaring, sulphur smells and pollution, indicating that they and their children were suffering from breathing difficulties, skin rashes, nosebleeds, headaches, and other health ailments.[49] The oil field is operated by Karachaganak Petroleum Operating BV, an international consortium comprised of Shell (the Netherlands), ENI (Italy), Chevron (US), Lukoil (Russia) and KazMunaiGaz (Kazakhstan). Businesses operating at Karachaganak routinely violated emission standards and were fined millions of dollars.

22. In 2008, the Supreme Court of Kazakhstan ruled that residents of Berezovka were entitled to information about emissions from Karachaganak that had been withheld as 'confidential business information.' On November 28, 2014, as a result of toxic emissions from an accident at Karachaganak, 25 children from Berezovka suffered severe medical problems, some of which continue to the present day. A number of these children were diagnosed with toxic encephalopathy, a range of brain dysfunctions caused by exposure to toxic chemicals.[50] These events, combined with pressure from the community and international organizations, led to the relocation of the entire community of Berezovka to a nearby village called Aksai, over a period of three years from 2015-2017.[51] Hydrogen sulphide emissions from Karachaganak are also linked to high levels of cardiovascular disease in nearby communities.[52]

23. The small island State of Nauru has endured massive environmental degradation caused by phosphate mining.[53] As one scholar explained, the history of this country "presents the stark plight of a people whose verdant island home, once known as 'Pleasant Island,' has been transformed by mining into a scarred wasteland."[54] A century of phosphate mining on Nauru has created an extreme health crisis for its inhabitants, including cadmium poisoning due to the contamination of groundwater and high rates of diabetes due to loss of traditional foods and agricultural lands.[55] In 1989, Nauru took legal action against Australia in the International Court of Justice regarding Australia's mishandling of the administration of the island, with an emphasis on Australia's failure to remedy the environmental damage caused by phosphate mining. The litigation led to an out-of-court settlement to rehabilitate the mined-out areas of Nauru.[56] A similarly bleak scenario for Indigenous peoples has

[46] UN Environment Programme, 2015, "Air Quality Policies: Indonesia". See https://wedocs.unep.org/bitstream/handle/20.500.11822/17217/Indonesia.pdf

[47] See Associated Press, 2021, "Indonesian President found to be negligent over Jakarta Pollution," *New York Times*, 16 September 2021.

[48] Kenesariev UI, Erzhanova AE, Amrin MK, Kenesary DU, Dosmukhametov AT, Baĭmukhamedov AA. "[Hygienic evaluation and prediction of population morbidity in the region of the Karachaganak field]." *Gig Sanit.* 2013 Sep-Oct;(5):83-6.

[49] K. Watters, 2009, "The Fight for Community Justice Against Big Oil in the Caspian Region," in J. Agyeman and Y. Ogneva-Himmelberger, eds., *Environmental Justice and Sustainability in the Former Soviet Union*, MIT Press, pp. 153-188.

[50] Kim Y, Kim JW. "Toxic encephalopathy." *Saf Health Work*. 2012; 3(4): 243-256.

[51] See https://readymag.com/Afterword/index/4/ and https://crudeaccountability.org/campaigns/karachaganak/

[52] Kenessary D, Kenessary A, Kenessariyev UI, Juszkiewicz K, Amrin MK, Erzhanova AE. "Human health cost of hydrogen sulfide air pollution from an oil and gas field." *Ann Agric Environ Med.* 2017;2 4(2): 213-216. doi:10.26444/aaem/74562.

[53] M. Butusov and A. Jernelöv, 2013, *Phosphorus: An element that could have been called Lucifer.* New York: Springer.

[54] Anghie, A. 1993, "Heart of my home: colonialism, environmental damage, and the Nauru case", *Harvard International Law Journal*, no. 2, p. 445-506 at 446.

[55] The Australian Lawyers Alliance 2017, letter to the Parliament of Australia, "Urgent: risk of cadmium poisoning on Nauru", 24 February.

[56] *Certain Phosphate Lands: Nauru v. Australia.* See also Clifford MJ, Ali SH, Matsubae K. "Mining, land restoration and sustainable development in isolated islands: An industrial ecology perspective on extractive transitions on Nauru." *Ambio.* 2019 Apr;48(4):397-408.

occurred because of phosphate mining on Banaba Island in Kiribati, as the entire population was coerced into relocating to an island in Fiji.[57]

24. The Kim Kim River is one of the most polluted rivers in Malaysia.[58] In 2019, there was a terrible incident of hazardous waste being dumped into the river near several schools in Pasir Gudang. More than 5,000 children suffered breathing difficulties, nausea, vomiting and dizziness because of exposure to toxic chemicals including acrylonitrile, benzene, hydrogen chloride, methane, toluene, xylene, ethylbenzene and d-limonene.[59] Another study confirmed high concentrations of polycyclic aromatic hydrocarbons on the surface of the Kim Kim River, raising the risk of cancer.[60] The long-term effects of these toxic exposures are unknown, but must be placed in the context of recurring pollution problems in this region of Malaysia. Similarly, illegal dumping of toxic waste containing lead from a battery recycling facility in Jenjarom, Malaysia, jeopardized the health of thousands of children in the area.[61]

25. The Aral Sea region is widely regarded as an ecological disaster, especially in Kazakhstan and Uzbekistan. Levels of toxic substances, including dioxins and beta-hexachlorocyclohexane (β-HCH), in women's breast milk and children's blood are among the highest ever documented.[62] Children in the Aral Sea region suffer from a range of conditions caused by exposure to toxic substances, including impacts on brain and motor skill development, respiratory illnesses, anaemia, diarrheal diseases, hypercalciuria and renal tubular dysfunction. Muynak (Uzbekistan) has among the highest estimated prevalence rates of childhood anaemia in the world.[63] Children are also suffering from growth retardation, heart disease and kidney disease. Adults suffer from elevated rates of cancer, including liver, oesophageal, lung and stomach cancer.[64] The dramatic shrinkage of the Aral Sea has increased salt concentration in the water tenfold, while also contributing to massive dust storms that wreak havoc on air quality. Perhaps not surprisingly, surveys show that the majority of people in this region believe the environmental disaster is contributing to their poor health and would like to emigrate.[65]

26. As is the case for other countries in South Asia, air pollution is a terrible problem in Pakistan. Pakistan experienced a sharp rise in air pollution levels since 2010 and now endures very high $PM_{2.5}$ concentrations.[66] Air pollution causes approximately 235,700 premature deaths annually in Pakistan from heart disease, stroke, respiratory illnesses and cancer.[67] Vehicles on the road in Lahore doubled between 2012 and 2019, the number of industrial facilities grew to more than 15,000, and there is some transboundary pollution from India.

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[57] M. Treagus, 2021, "Flight of the frigate bird: Ocean Island, phosphate mining and *Project Banaba*", *Journal of Human Rights and the Environment*, 12,1: 103-32.

[58] Ibrahim MF, Hod R, Toha HR, Mohammed Nawi A, Idris IB, Mohd Yusoff H, Sahani M. "The Impacts of Illegal Toxic Waste Dumping on Children's Health: A Review and Case Study from Pasir Gudang, Malaysia." *Int J Environ Res Public Health.* 2021 Feb 24; 18(5): 2221.

[59] R. Abdullah, 2020, "Malaysia: Report on Children's Environmental Health," *Rev. Environ. Health* 35,1: 49-52.

[60] Keshavarzifard, M.; Zakaria, M.P.; Keshavarzifard, S.; Sharifi, R. "Distributions, Composition Patterns, Sources and Potential Toxicity of Polycyclic Aromatic Hydrocarbons (PAHs) Pollution in Surface Sediments from the Kim Kim River and Segget River, Peninsula Malaysia." Available online: http://www.pertanika.upm.edu.my/

[61] R. Abdullah, 2020, "Malaysia: Report on Children's Environmental Health," *Rev. Environ. Health* 35,1: 49-52.

[62] Crighton EJ, Barwin L, Small I, Upshur R. "What have we learned? A review of the literature on children's health and the environment in the Aral Sea area." *Int J Public Health*. 2011; 56(2): 125-138.

[63] All preceding information in this paragraph is from Crighton EJ, Barwin L, Small I, Upshur R. "What have we learned? A review of the literature on children's health and the environment in the Aral Sea area." *Int J Public Health*. 2011; 56(2): 125-138.

[64] Wæhler TA, Dietrichs ES. "The vanishing Aral Sea: health consequences of an environmental disaster." *Tidsskr Nor Laegeforen.* 2017 Oct 2; 137(18).

[65] Ibid.

[66] M.M. Majeed and A Munir, 2020, "Pakistan: country report on children's health." *Rev. Environ. Health* 35,1: 57-63.

[67] State of Global Air Quality, 2020, https://www.stateofglobalair.org/data/#/health/plot

Over a 5-year period, the average annual levels of fine particles ($PM_{2.5}$) in Lahore were 14 times higher than the WHO air quality guidelines. In 2016, a severe smog episode occurred in Lahore, with nitrogen oxide levels 17 times higher than usual, causing a range of adverse health effects. Hundreds of people suffered such severe eye irritation from the smog that they went to local hospitals for treatment.[68] Scientists wrote that "Lahore has once again been engulfed by a disturbingly heavy blanket of smog, shrouding the entire city and taking a toll on people's lives."[69]

27. Chromite mining in the Sukinda Valley produces the majority of chromite in India but comes at a high cost for residents of the valley because chromite mining causes the contamination of groundwater with hexavalent chromium, a known carcinogen.[70] The mining process also causes elevated levels of air pollution, harming people's health and leading researchers to describe the region as one of the most polluted places in the world.[71]

28. In 1998, a massive volume of lead-contaminated mine tailings spilled into Klity Creek in Kanchanaburi Province, Thailand. Children in nearby villages were exposed to lead through water, food and soil. All children who were subsequently tested were suffering from blood lead levels above 10 microg/dl, the recommended threshold for government intervention. These children frequently reported nausea, vomiting, abdominal pain, constipation, concentration problems, muscle pains, headaches, insomnia, and memory loss, all of which are symptoms of lead poisoning.[72] Blood lead levels were associated with substantially lower IQ levels compared to non-exposed children, leading researchers to conclude that "The children in this study who were exposed to environmental lead had an accumulation of lead in their bodies. This resulted in a great impact on intellectual development."[73]

29. Residents in the Klity Creek area filed lawsuits seeking remediation because the government was relying on natural regeneration, which was not working.[74] The Supreme Court of Thailand ruled in favour of the villagers in 2013, ordering the government to reduce levels of lead contamination to acceptable levels in water, sediment, aquatic animals, soil, and vegetation in and around the creek. In 2016, 18 years after the spill, lead concentrations in the affected waters and sediments were still extremely high. Researchers determined that this was because lead was continuing to leak out of the tailings ponds into surrounding waters and soils. The budget for the restoration project is $US15 million, and all stakeholders agree that remediation targets will not be easily achieved. Experts have concluded that in order "to achieve the remedial action goal ordered by the court, proper tailing ponds management is

[68] Ashraf A, Butt A, Khalid I, Alam RU, Ahmad SR. "Smog analysis and its effect on reported ocular surface diseases: a case study of 2016 smog event of Lahore." *Atmos Environ* 2019; 198: 257–64.

[69] Riaz R, Hamid K. "Existing Smog in Lahore, Pakistan: An Alarming Public Health Concern." *Cureus*. 2018; 10(1): e2111. Published 2018 Jan 25. doi:10.7759/cureus.2111

[70] Mishra, H., & Sahu, H. B. (2013). "Environmental scenario of chromite mining at Sukinda Valley—a review." *Int. J. Environ. Eng. Manag*, *4*, 287-292.

[71] Mishra, S.R., Pradhan, R.P., Prusty, B.A.K. *et al.* "Meteorology drives ambient air quality in a valley: a case of Sukinda chromite mine, one among the ten most polluted areas in the world." *Environ Monit Assess* 188, 402 (2016). https://doi.org/10.1007/s10661-016-5393-1.

[72] Pusapukdepob J, Sawangwong P, Pulket C, Satraphat D, Saowakontha S, Panutrakul S. "Health risk assessment of villagers who live near a lead mining area: a case study of Klity village, Kanchanaburi Province, Thailand." *Southeast Asian J Trop Med Public Health.* 2007 Jan;38(1):168-77. PMID: 17539264.

[73] Pusapukdepob J, Sawangwong P, Pulket C, Satraphat D, Saowakontha S, Panutrakul S. "Health risk assessment of villagers who live near a lead mining area: a case study of Klity village, Kanchanaburi Province, Thailand." *Southeast Asian J Trop Med Public Health.* 2007 Jan;38(1):168-77. PMID: 17539264.

[74] Phenrat T, Otwong A, Chantharit A, Lowry GV. 2016. "Ten-year monitored natural recovery of lead-contaminated mine tailing in Klity Creek, Kanchanaburi Province, Thailand." *Environ Health Perspect* 124: 1511-1520; http://dx.doi.org/10.1289/EHP215.

imperative."[75] In the meantime, villagers continue to drink water and eat fish contaminated with lead because their options are limited.

Eastern Europe

30. Skopje, North Macedonia is one of the most polluted cities in Eastern Europe, and "has historically experienced frequent episodes of heavy pollution".[76] Annual concentrations of fine particulate matter (58µg/m^3) are more than double the European Union (EU) annual limit value (25µg/m^3) and more than ten times higher than the limit recommended by the World Health Organization (5µg/m^3). Skopje has a large number of industrial facilities, high traffic volumes, and relies heavily on biomass burning. In recent years, the 24 hour EU limit was exceeded on 77% of days.[77] Air pollution reduces the average life expectancy of the residents of Skopje by 2 to 3 years.[78] In 2012, long-term exposure to fine particulate matter in Skopje caused an estimated 1,200 premature deaths, 1,500 hospital admissions and costs of between 570 million euros and 1.47 billion euros.[79] Complying with the EU air quality directive for fine particulate matter would slash these figures in half.[80]

31. Thirty-six of Europe's 50 most polluted cities are located in Poland, largely as a result of coal-fired power plants and residential heating with wood and coal.[81] Air quality is particularly bad in Silesia, where exposure to elevated levels of particulate matter, benzo(a)pyrene and other toxic substances has contributed to significantly shorter life expectancy for both men and women.[82] Mining and smelting in Silesia have discharged so much lead, cadmium, zinc and other heavy metals that soils are contaminated to the point

[75] Srirattana S, Piaowan K, Imthieang T, Suk-In J, Phenrat T. "Assessment of Lead (Pb) Leakage From Abandoned Mine Tailing Ponds to Klity Creek, Kanchanaburi Province, Thailand." *Geohealth.* 2021 May 1; 5(5): e2020GH000252. doi: 10.1029/2020GH000252. PMID: 33977179; PMCID: PMC8101536.

[76] Martinez GS, Spadaro JV, Chapizanis D, Kendrovski V, Kochubovski M, Mudu P. "Health Impacts and Economic Costs of Air Pollution in the Metropolitan Area of Skopje." *Int J Environ Res Public Health.* 2018 Mar 29; 15(4): 626. doi: 10.3390/ijerph15040626. PMID: 29596347; PMCID: PMC5923668.

[77] Almeida SM, Manousakas M, Diapouli E, Kertesz Z, Samek L, Hristova E, Šega K, Alvarez RP, Belis CA, Eleftheriadis K; IAEA European Region Study GROUP. "Ambient particulate matter source apportionment using receptor modelling in European and Central Asia urban areas." *Environ Pollut.* 2020 Nov; 266(Pt 3): 115199. doi: 10.1016/j.envpol.2020.115199. Epub 2020 Jul 15. PMID: 32777678.

[78] Dimovska M, Mladenovska R. "Losing Years of Human Life in Heavy Polluted Cities in Macedonia." *Maced J Med Sci.* 2019 Feb 6;7(3):428-434. doi: 10.3889/oamjms.2019.149. PMID: 30834015; PMCID: PMC6390152.

[79] Martinez GS, Spadaro JV, Chapizanis D, Kendrovski V, Kochubovski M, Mudu P. "Health Impacts and Economic Costs of Air Pollution in the Metropolitan Area of Skopje." *Int J Environ Res Public Health.* 2018 Mar 29; 15(4): 626. doi: 10.3390/ijerph15040626. PMID: 29596347; PMCID: PMC5923668.

[80] Ibid.

[81] Nazar W, Niedoszytko M. "Air Pollution in Poland: A 2022 Narrative Review with Focus on Respiratory Diseases." *Int J Environ Res Public Health.* 2022 Jan 14; 19(2): 895. doi: 10.3390/ijerph19020895. PMID: 35055718. Dziubanek G, Spychała A, Marchwińska-Wyrwał E, Rusin M, Hajok I, Ćwieląg-Drabek M, Piekut A. "Long-term exposure to urban air pollution and the relationship with life expectancy in cohort of 3.5 million people in Silesia." *Sci Total Environ.* 2017 Feb 15; 580: 1-8. Toczylowski K, Wietlicka-Piszcz M, Grabowska M, Sulik A. "Cumulative Effects of Particulate Matter Pollution and Meteorological Variables on the Risk of Influenza-Like Illness." *Viruses*. 2021;13(4):556.

[82] Dziubanek G, Spychała A, Marchwińska-Wyrwał E, Rusin M, Hajok I, Ćwieląg-Drabek M, Piekut A. "Long-term exposure to urban air pollution and the relationship with life expectancy in cohort of 3.5 million people in Silesia." *Sci Total Environ.* 2017 Feb 15;580: 1-8. Kobza J, Geremek M, Dul L. "Characteristics of air quality and sources affecting high levels of PM_{10} and $PM_{2.5}$ in Poland, Upper Silesia urban area." *Environ Monit Assess*. 2018;190(9):515.

where vegetables grown in allotment gardens pose a significant health risk to their consumers.[83]

32. Estonia is among the largest per-capita emitters of CO_2 in the European Union (EU) and one of the most carbon-intensive economies in the OECD, with over 90 per cent of Estonia's greenhouse gas emissions from burning oil shale for electricity.[84] Oil shale is the primary contributor to extensive contamination of ground and surface water supplies, soil, and harm to the health of residents in the mining region of Ida-Viru county. As of 2017, Estonia generated 35 times the EU average in hazardous waste per capita, predominantly because of the oil shale industry.[85] The levels at which oil shale residue has accumulated in some Estonian landfills has resulted in risks of self-ignition and leaching, with consequent negative impacts on air quality and groundwater.[86] The city of Kohtla-Järve in Ida-Viru often has to deal with elevated concentrations of hydrogen sulfide and sulfur dioxide in the air due to its location downwind from a major shale oil processing facility.[87] Wastewater from the shale oil mines has altered the chemical composition of both the surface water and groundwater, with high sulphate concentrations being of particular concern.[88] A government study on the health impacts of the oil shale sector concluded that the overall health of residents of Ida-Viru county is worse than people living elsewhere in Estonia, "principally due to environmental pollution originating from the oil shale sector".[89] Because of poor air quality, the rates of respiratory disorders diagnosed in children and mortality from heart disease are higher.[90] Rates of lung cancer are higher in the oil shale regions of Estonia than elsewhere in the country.[91] Compared to individuals from non-industrial areas in Estonia, residents of Ida-Viru more frequently reported wheezing, chest tightness, shortness of breath, asthma attacks, long-term coughs, hypertension, heart disease, stroke, and diabetes. The life expectancy of a child born in Ida-Viru is four years shorter than a child born elsewhere in Estonia. Workers in the oil shale sector experience much higher levels of "respiratory diseases, hypertension, stroke, heart diseases and diabetes".[92]

33. Slavonski Brod is a city of 60,000 people in eastern Croatia near the border with Bosnia and Herzegovina. Air quality in Slavonski Brod is notoriously poor, especially in the winter months, when particulate levels have reached as high as 240 $\mu g/m^3$, sixteen times higher than the short-term limit recommended by the World Health Organization.[93] The main sources of particulate matter (~45%) in Slavonski Brod are an oil refinery across the border in a Bosnia and Herzegovina and domestic heating, while vehicle traffic makes a minor contribution. The primary source of sulfur dioxide (99%) and nitrogen oxides (~80%) is the oil refinery, while traffic contributes the remainder of the nitrogen oxide emissions. The oil

[83] Ćwieląg-Drabek M, Piekut A, Gut K, Grabowski M., 2020, "Risk of cadmium, lead and zinc exposure from consumption of vegetables produced in areas with mining and smelting past." *Sci Rep*. 2020; 10(1): 3363.

[84] Organization for Economic Cooperation and Development, 2017, *OECD Environmental Performance Reviews: Estonia 2017*, OECD Environmental Performance Reviews, OECD Publishing, Paris, https://doi.org/10.1787/9789264268241-en. *Chapter 5*.

[85] Ibid.

[86] Vallner L, Gavrilova O, Vilu R. "Environmental risks and problems of the optimal management of an oil shale semi-coke and ash landfill in Kohtla-Järve, Estonia." *Sci Total Environ.* 2015 Aug 15; 524-525: 400-15. doi: 10.1016/j.scitotenv.2015.03.130. Epub 2015 Apr 27. PMID: 25930241.

[87] Pavlenkova, J., Kaasik, M., Kerner, E., Loot, A., & Ots, R. (2011). "The Impact of Meteorological Parameters on Sulphuric Air Pollution in Kohtla-Järve." *Oil Shale*, 28(2), 337. p.337-8.

[88] Organization for Economic Cooperation and Development, 2017, *OECD Environmental Performance Reviews: Estonia 2017- Chapter 5,* p. 14.

[89] *Ibid.* p. 17.

[90] *Ibid.*

[91] Idavain J, Lang K, Tomasova J, Lang A, Orru H. 2020, "Cancer Incidence Trends in the Oil Shale Industrial Region in Estonia." *Int J Environ Res Public Health*. 2020; 17(11): 3833. Published 2020 May 28. doi:10.3390/ijerph17113833

[92] Organization for Economic Cooperation and Development, 2017.

[93] Gvozdić V, Brana J, Malatesti N, Puntarić D, Vidosavljević D, Roland D. "An analysis of the pollution problem in Slavonski Brod (eastern Croatia)." *Coll Antropol.* 2011 Dec; 35(4): 1135-41. PMID: 22397250.

refinery also is a major source of toxic hydrogen sulfide emissions.[94] In 2008, an accident contaminated this community's drinking water supply with heavy oil. Residents complained of symptoms such as diarrhoea, stomach cramps, vomiting, rashes, eye burning, chills, and gastric disorders.[95]

34. Plovdiv, Bulgaria is a pollution hotspot, with poor air quality, contaminated water, and soils polluted by heavy metals including lead, zinc, cadmium and mercury. In 2008, Plovdiv was ranked as the worst European city for air quality, while a 2019 report by the European Environment Agency noted that levels of particulate matter still exceeded European Union limits.[96] Major sources of pollution include heavy industry, traffic and the large KCM lead-zinc smelter near Plovdiv.[97] In 2019, exposure to particulate matter caused an estimated 10,600 premature deaths in Bulgaria.[98]

35. A major water and soil pollution problem in Hungary involves unremediated contaminated sites created by heavy industry and Soviet military bases. Toxic chemicals deposited without proper containment seep into the ground and reach aquifers, contaminating drinking water and potentially violating the human rights to a healthy environment and health. The Ombudsman for Future Generations found that such violations occurred when the state failed to abate such pollution in an effective way.99 The National Remediation Program, which provides financial resources from the central budget to remediate contaminated sites, could be a major tool to mitigate pollution originating from historical environmental damage. The effectiveness of this program is, however, constrained due to limited resources. The Ombudsman for Future Generations issued a package of legislative recommendations on environmental liability to boost the effectiveness of the program and prevent future contaminated sites.[100]

36. Coal mining, coal-fired power plants and associated infrastructure have caused the relocation of more than 100 communities and 90,000 people in the Czech Republic since 1949. Since achieving independence in 1989, the Czech Republic has required reductions in pollution from coal-fired power plants and has set some limits on coal mining. However, air pollution continues to threaten human health. A study published in 2014 found that coal-fired power plants tended to be located in regions with higher proportions of ethnic minorities and people with less education.[101] Residents of these regions suffered from the highest concentrations of air pollution, higher levels of infant mortality and lower life expectancy.[102] Ostrava, the third largest city in the Czech Republic, is the most polluted city in the country and one of the most polluted in the European Union.[103] Coal mining, the use of coal to

[94] Jeričević A, Gašparac G, Mikulec MM, Kumar P, Prtenjak MT. "Identification of diverse air pollution sources in a complex urban area of Croatia." *J Environ Manage.* 2019 Aug 1; 243:6 7-77. doi: 10.1016/j.jenvman.2019.04.024. Epub 2019 May 9. PMID: 31078930.

[95] Medverec Knežević Z, Nadih M, Josipović R, Grgić I, Cvitković A. Zagađenje pitke vode mineralnim uljima u Slavonskom Brodu "[Mineral oil drinking water pollution accident in Slavonski Brod, Croatia]." *Arh Hig Rada Toksikol.* 2011 Dec; 62(4): 349-56. Croatian. doi: 10.2478/10004-1254-62-2011-2119. PMID: 22202469.

[96] European Environment Agency, 2019, *Europe's urban air quality — Re-assessing implementation challenges for cities*, EEA Report No. 24/2018, European Environment Agency. See https://www.eea.europa.eu/publications/europes-urban-air-quality

[97] Dimitrov DS, Nedyalkova MA, Donkova BV, Simeonov VD. "Chemometric Assessment of Soil Pollution and Pollution Source Apportionment for an Industrially Impacted Region around a Non-Ferrous Metal Smelter in Bulgaria." *Molecules*. 2019;24(5):883. Published 2019 Mar 2. doi:10.3390/molecules24050883

[98] European Environment Agency, 2021, *Health Impacts of Air Pollution in Europe*, https://www.eea.europa.eu/publications/air-quality-in-europe-2021/health-impacts-of-air-pollution

[99] Submission from Ombudsman for Future Generations, case numbers: AJB-813/2012, AJB-831/2012.

[100] Submission from Ombudsman for Future Generations, case number: AJB-1495/2019.

[101] Frantal B., Novakova E. "A curse of coal? Exploring unintended regional consequences of coal energy in the Czech Republic." *Morav. Geogr. Rep.* 2014; 22: 55–65. doi: 10.2478/mgr-2014-0012.

[102] Frantal B., Novakova E. "A curse of coal? Exploring unintended regional consequences of coal energy in the Czech Republic." *Morav. Geogr. Rep.* 2014; 22: 55–65. doi: 10.2478/mgr-2014-0012.

[103] Bitta J, Svozilík V, Svozilíková Krakovská A. "Effect of the COVID-19 Lockdown on Air Pollution in the Ostrava Region." *Int J Environ Res Public Health*. 2021; 18(16): 8265. Published 2021 Aug 4. doi:10.3390/ijerph18168265

generate electricity, domestic heating, steel production, chemical plants and heavy industry are to blame. Toxic substances of particular concern are particulate matter, benzene, and benzo[a]pyrene, which are contributing to high levels of infant mortality, bronchitis, heart disease and lung cancer, as well as premature deaths.[104]

Latin America and the Caribbean

37. Colombia's massive El Cerrejon open-pit coal mine has had devastating consequences for neighbouring Wayuú Indigenous communities. According to the Constitutional Court of Colombia, the mining operations have caused: emission of large volumes of hazardous air pollution (including fine particulate matter, nitrogen oxides, polycyclic aromatic hydrocarbons, sulphur, chromium, copper and zinc) in excess of Colombian standards and WHO guidelines; noise pollution exceeding Colombian standards; and damage, contamination and exhaustion of the local water supply.[105] Residents near the mine suffer from high rates of respiratory illness and have elevated levels of toxic substances in their blood. Transnational mining companies have generated billions of dollars in revenue at El Cerrejon, but adjacent Wayuú communities live in extreme poverty. For example, roughly half of Wayuú children suffer from malnutrition and stunting.[106] Workers at El Cerrejon also face elevated risks due to exposures to toxic substances.[107]

38. The Vaca Muerta oil and gas megaproject in Argentina is causing a huge amount of environmental destruction in the Province of Neuquén. Fracking for oil and gas consumes vast quantities of water. Yet Argentina's Second Nationally Determined Contribution under the Paris Agreement identifies major concerns about potential water shortages, droughts and desertification in the Vaca Muerta region.[108] Fracking has caused earthquakes and discharged immense volumes of toxic substances into the air, water and soil. Particularly impacted are the Mapuche Indigenous peoples of Neuquén. Water that flows to the surface from oil and gas wells, called produced water or production water, can contain a wide range of toxic chemicals, from heavy metals to polycyclic aromatic hydrocarbons. These substances can contaminate groundwater. Potential health impacts of fracking include respiratory illnesses, heart disease and cancer, including childhood leukaemia.[109] In 2018 the UN Committee on Economic, Social and Cultural Rights warned Argentina about the potential climate change impacts of Vaca Muerta: "The total exploitation, with hydraulic fracturing, of all the shale gas reserves would consume a significant percentage of the global carbon budget to achieve the goal of a 1.5 degrees Celsius warming".[110] On that basis, the Committee recommended that Argentine should reconsider the exploitation of unconventional hydrocarbons in the Vaca Muerta region.

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[104] Jiřík V, Machaczka O, Miturová H, Tomášek I, Šlachtová H, Janoutová J, Velická H, Janout V. "Air Pollution and Potential Health Risk in Ostrava Region - a Review." *Cent Eur J Public Health*. 2016 Dec; 24 Suppl: S4- S17. doi: 10.21101/cejph.a4533. PMID: 28160532.

[105] *Mariluz Uriana Ipuana and Yasmin Uriana*, Constitutional Court of Colombia, Decision T-614, 16 December, 2019.

[106] Russell EA, Daza Atehortua C, Attia SL, Genisca AE, Palomino Rodriguez A, Headrick A, Solano L, Camp EA, Galvis AM, Crouse HL, Thomas JA. "Childhood malnutrition within the indigenous Wayuú children of northern Colombia." *Glob Public Health*. 2020 Jun; 15(6): 905-917. doi: 10.1080/17441692.2020.1712448. Epub 2020 Jan 16.

[107] León-Mejía G, Espitia-Pérez L, Hoyos-Giraldo LS, Da Silva J, Hartmann A, Henriques JA, Quintana M. "Assessment of DNA damage in coal open-cast mining workers using the cytokinesis-blocked micronucleus test and the comet assay." *Sci Total Environ.* 2011 Jan 15; 409(4): 686-91. doi: 10.1016/j.scitotenv.2010.10.049. PMID: 21215992.

[108] Ministry of Environment and Sustainable Development (Argentina), 2020, Second Nationally Determined Contribution. See https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Argentina%20Second/Argentina_Segunda%20Contribución%20Nacional.pdf

[109] Wollin, Klaus-Michael et al. "Critical evaluation of human health risks due to hydraulic fracturing in natural gas and petroleum production." *Archives of Toxicology* vol. 94,4 (2020): 967-1016. doi:10.1007/s00204-020-02758-7

[110] E/C.12/ARG/CO/4 (1 November 2018), para. 13.

39. Despite being a global environmental leader, Costa Rica is also a leader in the use of toxic pesticides in its agricultural sector. Residents living in banana growing regions are exposed to a variety of pesticides including fungicides (e.g., mancozeb), insecticides (e.g., chlorpyrifos, cypermethrin), and herbicides (e.g., 2,4-D). Of particular concern is the continued use of mancozeb via aerial spraying on banana plantations. The EU banned mancozeb due to concerns that it may cause thyroid problems and neurodegenerative diseases. Talamanca, in the Limón Province, is a relatively underdeveloped region of Costa Rica with large Afro-descendant and Indigenous populations. High concentrations of ethylene thiourea, a metabolite of mancozeb, has been found in the urine of children living near banana plantations in Talamanca. These children suffer from a host of neurodevelopmental problems including impaired memory, poor visual motor coordination, poor verbal learning, reduced ability to discriminate between colours, oppositional disorders and cognitive challenges, such as inattention.[111] In Matina, not far from Talamanca, pregnant women living near banana and plantain plantations have elevated levels of ethylene thiourea, posing a risk to the neurological development of their unborn babies.[112] Prenatal pesticide exposure also jeopardizes respiratory health, with higher levels of exposure during pregnancy linked to higher risks of respiratory infections in the first year of life.[113]

40. In El Salvador, a lead battery recycling plant caused the government to declare a state of environmental emergency. Located in Sitio del Niño, in the municipality of San Juan Opico, this facility caused extensive air, soil and water contamination. The most adversely affected persons were children in the community. Although some actions have been taken by the government, it is estimated that a comprehensive clean-up and rehabilitation project would cost more than $US 55 million, which the State says is not available.[114] Approximately 200 people with chronic lead poisoning have been treated, with blood lead levels for the vast majority returning to safe levels.[115]

41. The Atoyac and Santiago River basins in Mexico both suffer from extreme levels of industrial pollution, jeopardizing the health and human rights of residents in these watersheds.[116] The Atoyac River is home to approximately two million people and hosts more than 20,000 textile, petrochemical, automobile, agriculture and food businesses.[117] Water quality in the two rivers is classified as extremely poor, or even "dead".[118] High levels of cancer biomarkers in children, high prevalence of gastrointestinal diseases, kidney failure, osteoporosis, cardiovascular disorders, poor cognitive development in children and poor organ development have all been linked with the consumption and use of heavily

[111] van Wendel de Joode B, Mora AM, Lindh CH, Hernández-Bonilla D, Córdoba L, Wesseling C, Hoppin JA, Mergler D. "Pesticide exposure and neurodevelopment in children aged 6-9 years from Talamanca, Costa Rica." *Cortex*. 2016 Dec; 85: 137-150.

[112] van Wendel de Joode, Berna et al. "Aerial application of mancozeb and urinary ethylene thiourea (ETU) concentrations among pregnant women in Costa Rica: The Infants' Environmental Health Study (ISA)." *Environmental health perspectives* vol. 122,12 (2014): 1321-8. doi:10.1289/ehp.1307679

[113] Mora, Ana M et al. "Prenatal pesticide exposure and respiratory health outcomes in the first year of life: Results from the infants' Environmental Health (ISA) study." *International Journal of Hygiene and Environmental Health* vol. 225 (2020): 113474. doi:10.1016/j.ijheh.2020.113474

[114] Submission from El Salvador.

[115] Report on Actions taken by the Ministry of Health in Sitio del Nino to Respond to the Lead Contamination Environmental Emergency (2015). See https://cidoc.marn.gob.sv/documentos/informe-de-acciones-realizadas-por-el-ministerio-de-salud-en-el-canton-sitio-del-nino-municipio-de-san-juan-opico-en-atencion-a-la-emergencia-ambiental-por-contaminacion-por-plomo-agosto-2010-2015/

[116] Perez Castresana, G., Tamariz Flores, V., Lopez Reyes, L., Hernandez Aldana, F., Castelan Vega, R., Moran Perales, J., Garcia Suastegui, W., Diaz Fonesca, A., Handal Silva., A. (2018). "Atoyac River Pollution in the Metropolitan Area of Puebla, Mexico." *Water* 10(3): 267.

[117] Comisión Nacional de los Derechos Humanos, CNDH (2017). *Recomendación No. 10/2017*, CNDH, México City, México. Transnational Institute, (Corporate Power Team), 2021, *Transnational corporations and free trade in Mexico: Caravan on the social and environmental impacts*. Available at: https://www.tni.org/files/publication-downloads/report_caravan_toxitourmexico_eng.pdf

[118] Mastretta, S. (2017, 1 July). "Atoya, un río clínicamente muerto." *Nexos*. Available at: https://www.nexos.com.mx/?p=32776

contaminated water by local residents.[119] Further, the mortality rate for cancer in the basin is 13.5 times higher than Mexico's national average. In response to a series of complaints from local organizations, in 2017 Mexico's independent human rights institution issued a report recommending that governments take urgent action to clean up the Atoyac River.[120] In 2021 the area was declared an Environmental and Health Emergency Region, under the National Strategic Programmes on Toxic Substances and Polluting Processes (Programas Nacionales Estratégicos de Agentes Tóxicos y Procesos Contaminantes) that focus on health and water.[121] The Santiago River watershed is the subject of a recent decision of the Inter-American Commission on Human Rights requesting that Mexico implement precautionary measures to protect human rights from being harmed while the Commission adjudicates the case.[122]

42. Piquiá de Baixo is a community of 1,100 people in in the state of Maranhão in north-east Brazil that is suffering from extreme industrial pollution from mining and steel facilities located "in unimaginably close proximity", meaning right across the fenceline for some residents.[123] The UN Special Rapporteur on Toxics conducted a visit to Piquiá in 2020, publishing a highly critical report about the government's failure to protect the human rights and health of residents. A study examining the respiratory functions of hundreds of Piquiá residents found unprecedented levels of impairment, attributable to air pollution from the neighbouring steel plant.[124] The terrible conditions led the Special Rapporteur to support the community's plea for resettlement in a location where the air is safe to breathe.[125]

43. Along the western coast of Trinidad and Tobago there is a major concentration of industrial facilities, including an oil refinery, petrochemical plants, a cement plant, an oil shipping facility and iron and steel plants. Fossil fuel burning, gas flaring, and oil spills are causing very high levels of polycyclic aromatic hydrocarbons in the environment, posing a risk of cancer. As a result, scientists concluded that "the general population is exposed to high cancer risk from the consumption of seafood derived from this coastal area".[126] There have been hundreds of oil spills in the Gulf of Paria in recent years, including a major spill in 2021, with devastating consequences for the health, livelihoods and human rights of fisher folk in the area.[127] Beaches and rivers in this same area are suffering extremely high levels of faecal contamination, raising the risks of disease. A recent study concluded that "The high incident (*sic*) of faecal pollution of water bodies in Trinidad associated with human and bird

[119] Mora, A., Garcia-Gamboa, M., Sanchez-Luna, M., Gloria-Garcia, L., Cervantes-Aviles, P., Mahlknecht, J. (2021). "A review of the current environmental status and human health implications of one of the most polluted rivers of Mexico: The Atoyac River, Puebla." *Science of the Total Environment* 782: 1-16. Perez Castresana, G., Castaneda Roldan, E., Garcia Suastegui, W., Moran Perales, J., Cruz Montalvo, A., Handal Silva, A. (2019). "Evaluation of Health Risks Due to Heavy Metals in a Rural Population Exposed to Atoyac River Pollution in Puebla Mexico." *Water* 11(2): 277.

[120] Comisión Nacional de los Derechos Humanos, CNDH (2017). *Recomendación No. 10/2017*; CNDH, México City, México.

[121] Cortes-Hernandez, J.H. (2021). "Historical origin of water pollution and legal analysis of the Atoyac River." *Tecnología y Ciencias del Agua* 12(1): 133-191. Zambrano, J. (2021, 17 June). "Dale la Cara Al Atoyac pide crear políticas y acciones ambientales." *Milenio*. Available at: https://www.milenio.com/politica/comunidad/dale-cara-atoyac-pide-politicas-sostenidas-delitos-ambientales

[122] Inter-American Commission on Human Rights, *Inhabitants of the areas near the Santiago River regarding Mexico*, resolution 7/2020, precautionary measure No. 708-19, 5 February 2020.

[123] Special Rapporteur on toxics and human rights, A/HRC/45/12/Add.2.

[124] Valenti C, Pozzi P, Busia A, Mazza R, Bossi P, De Marco C, Ruprecht AA, Borgini A, Boffi R. "Respiratory illness and air pollution from the steel industry: the case of Piquiá de Baixo, Brazil (Preliminary report)." *Multidiscip Respir Med.* 2016 Nov 9; 11: 41.

[125] Special Rapporteur on toxics and human rights, A/HRC/45/12/Add.2.

[126] Balgobin A, Ramroop Singh N. "Source apportionment and seasonal cancer risk of polycyclic aromatic hydrocarbons of sediments in a multi-use coastal environment containing a Ramsar wetland, for a Caribbean island." *Sci Total Environ.* 2019 May 10; 664: 474-486.

[127] See https://science.thewire.in/environment/trinidad-disaster-outrage-its-a-sea-of-oil-let-the-whole-country-see/

faecal pollution is particularly alarming and represents a serious public health risk on the island."[128]

44. Artisanal and small-scale gold mining is creating an environmental health disaster in Suriname, with thousands of kilograms of toxic mercury entering aquatic environments and the atmosphere annually.[129] The mercury bioaccumulates in the food chain and then poisons people who eat fish caught in local rivers and streams. Individuals in poor, predominantly Indigenous communities in Suriname that are downstream from mining activities and dependent upon local fish as a major element of their diets are the hardest hit. Hair samples taken from residents of Puleowime, for example, indicate mercury levels 10 to 20 times higher than what is considered safe.[130] These individuals display symptoms of neurological disorders caused by mercury exposure. New-borns in the community likely suffered prenatal damage due to mercury poisoning.[131]

45. Coastal oil development has devastating consequences for artisanal and small-scale fishers, including displacement, habitat destruction, pollution, reduced catches and the lack of a fair share of benefits from oil development.[132] Unmaintained oil infrastructure in Venezuela is resulting in thousands of oil spills annually, from minor to catastrophic.[133] In recent years major oil spills have occurred at the Paraguaná refinery complex, Pirial de Punta de Mata in Monangas State, Rio Seco, and the El Palito refinery in Carabobo State, releasing oil into Morrocoy National Park. Oil spills can be disastrous for the health, livelihoods, culture and human rights of persons living in coastal communities. Fish and shellfish can be contaminated, threatening an important food source. Exposure to toxic oil can cause symptoms including trouble breathing, heart problems, headaches, and irritated eyes. Women may be disproportionately affected, because they often spend more time in the water than men, are more likely to be excluded from social safety nets, and the shellfish they often collect tend to accumulate toxic substances.[134] The Paraguaná Peninsula in Venezuela is home to one of the world's largest oil refineries, generating massive volumes of air and water pollution, including polycyclic aromatic hydrocarbons, oil spills, particulate matter, sulfur compounds and heavy metals (e.g. cadmium, lead and mercury). The high levels of pollution are contaminating fish and other aquatic species, posing a risk to coastal communities that depend on them for food and livelihoods.[135]

[128] Bridgemohan RSH, Bachoon DS, Wang Y, Bridgemohan P, Mutiti C, Ramsubhag A. "Identifying the primary sources of faecal contamination along the beaches and rivers of Trinidad." *J Water Health.* 2020 Apr;18(2):229-238.

[129] Ouboter PE, Landburg G, Satnarain GU, Starke SY, Nanden I, Simon-Friedt B, Hawkins WB, Taylor R, Lichtveld MY, Harville E, Wickliffe JK. "Mercury Levels in Women and Children from Interior Villages in Suriname, South America." *Int J Environ Res Public Health.* 2018 May 17; 15(5): 1007.

[130] Daniel Peplow & Sarah Augustine. "Neurological abnormalities in a mercury exposed population among indigenous Wayana in Southeast Suriname*." Environ Sci Process Impacts.* 16, no. 10 (2014). 2415-2422.

[131] Gaitree K Baldewsingh et al. "Prenatal Mercury Exposure in Pregnant Women from Suriname's Interior and Its Effects on Birth Outcomes." *Int J Environ Res Public Health*. 17, no. 11 (2020). 4032. Jeffrey K Wickliffe et al. "Exposure to total and methylmercury among pregnant women in Suriname: sources and public health implications." *J Expo Sci Environ Epidemiol.* 31, no. 1 (2021). 117-125.

[132] Nathan Andrews, Nathan J. Bennett, Philippe Le Billon, Stephanie J. Green, Andrés M. Cisneros-Montemayor, Sandra Amongin, Noella J. Gray, U. Rashid Sumaila, 2021, "Oil, fisheries and coastal communities: A review of impacts on the environment, livelihoods, space and governance," *Energy Research & Social Science*, 75: 102009, https://doi.org/10.1016/j.erss.2021.102009.

[133] PROVEA. (2020, October 1). PDVSA spilled at least 866,722.85 barrels of oil into the environment between 2010 and 2018. *Hearts on Venezuela*. http://www.heartsonvenezuela.com/pdvsa-spilled-at-least-866722-85-barrels-of-oil-into-the-environment-between-2010-and-2018/

[134] de Oliveira Estevo, M., Lopes, P. F. M., de Oliveira Júnior, J. G. C., Junqueira, A. B., de Oliveira Santos, A. P., da Silva Lima, J. A., Malhado, A. C. M., Ladle, R. J., & Campos-Silva, J. V. (2021). "Immediate social and economic impacts of a major oil spill on Brazilian coastal fishing communities." *Marine Pollution Bulletin*, *164* (December 2020). https://doi.org/10.1016/j.marpolbul.2021.111984

[135] Croquer A, Bone D, Bastidas C, Ramos R, García E. "Monitoring coastal pollution associated with the largest oil refinery complex of Venezuela." *PeerJ.* 2016 Jun 23; 4: e2171. doi: 10.7717/peerj.2171. PMID: 27375970; PMCID: PMC4928465.

46. One of the largest garbage dumps in the western hemisphere is found in Zone 3 of Guatemala City, the capital of Guatemala. Thousands of people work in the dump under extremely difficult conditions, looking for discarded items with value, such as recyclable materials, food, and household goods.[136] The following health issues are common to persons living in and/or working in large open garbage dumps: coughing, shortness of breath, asthma, burning in the eyes, itching, nausea, weight loss, anaemia, abdominal pains, chronic headaches, dengue fever, helminthiasis, hepatitis, tuberculosis, cholera and mental health problems.[137] There have been periodic landslides and fires in the Zone 3 garbage dump that have caused deaths and injuries.[138] A civil society organization called Safe Passage is working to provide children who live in and around the Zone 3 garbage dump with educational opportunities and access to health care.[139]

Western Europe and North America

47. People of African descent living in Flint, Michigan were poisoned by lead in their drinking water because of government negligence rooted in racism.[140] Although only 14 percent of Michigan's population is Black, over 56 percent of Flint residents are black, and the share of the population living below the poverty line is over 40 percent in Flint versus 17 percent in the State as a whole. In 2014, city officials switched the source of drinking water in an attempt to save money. Because of problems with faecal contamination of the water supply, extra chlorine was added. This led to increased corrosion of aging water pipes, which leached lead into drinking water. According to the World Health Organization, there is no safe level of lead exposure. Children and pregnant women are especially vulnerable to its adverse health impacts. Elevated lead levels have been detected in children in Flint.[141] Childhood exposure to lead is associated with various neurodevelopmental effects, mortality, impaired renal function, hypertension, impaired fertility and adverse pregnancy outcomes. For months after high lead levels were first measured in Flint's water, authorities continued to assert that the tap water was safe to drink. Not until 2016 was a state of emergency declared. Thousands of children in Flint suffered harm. Unfortunately, the disaster in Flint is not an isolated incident. Lead contamination of drinking water in the United States is a systemic problem, with disproportionate exposure suffered by people of colour and low-income communities.[142]

48. Residents of Jobos Bay, a predominantly Black community in Puerto Rico (United States of America), bear the brunt of high levels of air pollution from nearby power plants, including the Aguirre Power Complex, which burns diesel and bunker oil, and the AES coal-fired power plant. There are also high levels of PCBs in the soil, an artefact of heavy industrialization at a time of low environmental standards.[143] According to one scholar, "the lack of access to—and often the outright denial of—community participation in decisions that affect residents' ecology and quality of life highlights how the government and

[136] See https://www.vice.com/en/article/vdpbxm/the-basurero-is-burning-life-at-the-gates-of-hell-in-guatemala-city

[137] Cruvinel VRN, Marques CP, Cardoso V, et al. "Health conditions and occupational risks in a novel group: waste pickers in the largest open garbage dump in Latin America." *BMC Public Health*. 2019; 19(1): 581.

[138] Kumble, PA. "Reflections on Service Learning for a Circular Economy Project in a Guatemalan Neighborhood, Central America." *Sustainability*. 2019; 11(17): 4776.

[139] See https://www.safepassage.org

[140] Working Group of Experts on People of African Descent, *Environmental justice, the climate crisis and people of African descent,* A/HRC/48/78.

[141] Campbell C, Greenberg R, Mankikar D, Ross RD. "A Case Study of Environmental Injustice: The Failure in Flint." *Int J Environ Res Public Health*. 2016 Sep 27; 13(10): 951. doi: 10.3390/ijerph13100951. PMID: 27690065; PMCID: PMC5086690.

[142] Working Group of Experts on People of African Descent, *Environmental justice, the climate crisis and people of African descent,* A/HRC/48/78, para 28.

[143] Alegria H, Martinez-Colon M, Birgul A, Brooks G, Hanson L, Kurt-Karakus P. "Historical sediment record and levels of PCBs in sediments and mangroves of Jobos Bay, Puerto Rico." *Sci Total Environ.* 2016 Dec 15; 573: 1003-1009.

corporations systematically devalue local knowledge, cultural identity, and ecosystems."[144] Former Special Rapporteur on extreme poverty and human rights, Philip Alston, reported meeting "with people in the South of Puerto Rico living next to a mountain of completely unprotected coal ash which rains down upon them bringing illness, disability and death."[145]

49. Ella Kissi-Debrah was a child who lived near a major road in Lewisham (South London, United Kingdom). For most of her short life she was exposed to high levels of traffic-related air pollution, especially nitrogen dioxide (NO_2) and particulate matter (PM). She passed away at the age of nine, on 15 February 2013. After hearing extensive evidence from medical and pollution experts, a coroner's inquest into the cause of her death concluded that Ella "died of asthma contributed to by exposure to excessive air pollution".[146] This marked the first time ever that a coroner has identified air pollution as a contributory cause of a specific individual's illness and death.[147] Subsequently, researchers studying air quality and health impacts in South London found that short-term increases in exposure to NO_2, PM_{10} and $PM_{2.5}$ were associated with increases in the daily number of doctor visits related to respiratory problems and inhaler prescriptions.[148] This relationship between pollution and breathing difficulties is particularly pronounced in children.

50. Port Arthur, Texas, is severely impacted by air pollution emitted by the many refineries and chemical plants in the area, including the largest refinery in the United States of America, owned by Saudi Aramco. Many of the largest emitters of benzene, a known carcinogen, in the USA are located in Port Arthur. Local residents are also exposed to elevated levels of other toxic chemicals including chloroform, 1,2-dichloroethane, 1,2-dibromoethane, and 1,1,2-tetrachloroethane. In 2018, the top toxic air pollutants emitted by weight in Jefferson County were nitrate compounds (2,719,009 lbs), picric acid (1,323,965 lbs), n-hexane (1,086,958 lbs), ethylene (1,008,816 lbs), hydrogen cyanide (841,817 lbs), ammonia (828,867 lbs), 2,4-dinitrophenol (709,284 lbs), propylene (465,494 lbs), 1,3-butadiene (322,505 lbs), and benzene (322,505 lbs).[149] In 2002, a federal judge sentenced two Port Arthur and Port Neches chemical plant operators to 3 years in prison for their role in their plant's exceedingly high benzene emissions.[150] Staggering amounts of pollutants are emitted during maintenance, accidents, unexpected events, and start-up activities. For example, in 2010, an Exxon oil tanker spilled 462,000 gallons of crude oil into the Sabine-Neches Canal, forcing the evacuation of 136 Port Arthur residents.[151] The Texas Cancer Registry shows that African Americans in Jefferson County have ~15% higher rates of cancer and ~40% higher mortality from cancer than the average Texan.[152] Residents suffer from

[144] Hilda Lloréns (2021) "Toxic Racism in Puerto Rico's Sacrifice Zone," *NACLA Report on the Americas,* 53:3, 275-280.

[145] P. Alston, 2017, "Extreme Poverty in America", *The Guardian*, 15 Dec. 2017. See: https://www.theguardian.com/world/2017/dec/15/extreme-poverty-america-un-special-monitor-report

[146] Inner South London Coroner's Court, 2020, Inquest into the death of Ella Roberta Adoo Kissi-Debrah. See: https://www.innersouthlondoncoroner.org.uk/news/2020/nov/inquest-touching-the-death-of-ella-roberta-adoo-kissi-debrah

[147] Whitehouse A, Grigg J. "Air pollution and children's health: where next?" *BMJ Paediatr Open*. 2021; 5(1): e000706. Published 2021 Apr 13. doi:10.1136/bmjpo-2020-000706

[148] Ashworth M, Analitis A, Whitney D, Samoli E, Zafeiratou S, Atkinson R, Dimakopoulou K, Beavers S, Schwartz J, Katsouyanni K; STEAM project research group. "Spatio-temporal associations of air pollutant concentrations, GP respiratory consultations and respiratory inhaler prescriptions: a 5-year study of primary care in the borough of Lambeth, South London." *Environ Health.* 2021 May 7; 20(1): 54.

[149] US Environmental Protection Agency. *TRI Explorer.* See: https://www.epa.gov/toxics-release-inventory-tri-program/tri-data-and-tools

[150] Collins C. "Six Texas Oil Refineries Are Among the Nation's Worst Benzene Polluters, Data Shows." *Texas Observer*. 2020 Feb 6. See: https://www.texasobserver.org/benzene-oil-refineries-texas-coast/

[151] Natural Resources Defense Council. "Port Arthur, Texas: American Sacrifice Zone" 2014 Nov 13. See: https://www.nrdc.org/onearth/port-arthur-texas-american-sacrifice-zone

[152] Natural Resources Defense Council. "Port Arthur, Texas: American Sacrifice Zone." 2014 Nov 13. See: https://www.nrdc.org/onearth/port-arthur-texas-american-sacrifice-zone

asthma and are hospitalized for chronic obstructive pulmonary disease at twice the rate of other Texans.[153]

51. Due to the geographical location of Greece, thousands of migrants and refugees from a variety of different countries arrive every year, necessitating the construction of temporary and permanent camps. After a fire at the Moria camp, the Greek government hastily built a temporary migrant camp called Mavrovouni on the island of Lesbos, Greece. The land had been used as a firing range from 1926 until 2020, resulting in high levels of lead contamination.[154] Human Rights Watch and other CSOs raised concerns that the potential exposure to lead made this a highly unsuitable, even dangerous place for a migrant camp.[155] As noted earlier, there are no safe levels of lead, as any exposure can lead to irreversible health problems, with potentially severe lifelong consequences for babies and children.[156] Exposure during pregnancy can result in stillbirth, miscarriage, and low birth weight, and can negatively affect foetal brain development. At least 118 pregnant women and 2,552 children were at the Mavrovouni camp as of November 2020, according to government data.[157]

52. It is encouraging that the total number of deaths caused by air pollution in Germany has fallen from 64,600 in 1990 to 29,300 in 2019.[158] However, Germany continues to depend heavily on coal for electricity, generating air pollution that contributes annually to "20 percent of premature deaths, 1800 cases of chronic bronchitis, 1810 hospital admissions, and 79 000 asthma attacks in children".[159] One of the largest coal mining regions in Europe is the Rheinischen lignite zone in Germany. Since the beginning of the 20th century, more than 370 villages in Germany that were home to a total of approximately 120,000 inhabitants have been relocated due to open-pit lignite mining.[160] In 2020, the decision was made to relocate another five villages (Keyenberg, Kuckum, Unter- and Oberwestrich and Beverath) and their 1,600 residents to expand mining operations. The health of people living in communities adjacent to the mining operations is jeopardized by air pollution, which often exceeds legal limits set by the European Union.[161] In 2021, the European Court of Justice concluded that Germany "systematically and persistently" violated the annual limit for nitrogen dioxide in 26 zones including the Rhineland mining area.[162]

53. Asubpeechoseewagong Netum Anishinabek, also known as the Grassy Narrows First Nation, is an Indigenous community in Ontario, Canada. During the 1960s and 1970s, the Dryden Chemical Company discharged at least 9,000 kilograms of mercury into the Wabigoon-English River system, causing elevated levels of mercury in the river and

[153] Morris D, Barker P, Legator M. "Symptoms of Adverse Health Effects Among Residents from Communities Surrounding Chemical-Industrial Complexes in Southeast Texas. "*Archives of Environmental Health*. 2010 Aug 07; 59(3): 160-165.

[154] Sanderson, P., Qi, F., Seshadri, B., Wijayawardena, A., Naidu, R. (2018). "Contamination, Fate and Management of Metals in Shooting Range Soils: A review." *Land Pollution, 4*(2018), 175-187. https://doi.org/10.1007/s40726-018-0089-5

[155] Human Rights Watch. (2020 December 8). "Greece: Lead Poisoning Concerns in New Migrant Camp." See: https://www.hrw.org/news/2020/12/08/greece-lead- poisoning-concerns-new-migrant-camp

[156] World Health Organization [WHO], 2021. Lead poisoning, https://www.who.int/news-room/fact-sheets/detail/lead-poisoning-and-health

[157] Human Rights Watch. (2020 December 8). "Greece: Lead Poisoning Concerns in New Migrant Camp." See:https://www.hrw.org/news/2020/12/08/greece-lead-poisoning-concerns-new-migrant-camp

[158] Health Effects Institute, 2021, *State of Global Air*. See https://www.stateofglobalair.org/data/#/health/plot

[159] Balakrishnan V.S. "Germany's delayed coal phase-out and respiratory health." *Lancet Respir Med.* 2018 Feb; 6(2): 90-91.

[160] Ess, J. "Re-Location: Urban and architectural analysis of resettlement practices in the brown coal mining area of Welzow-Süd in East Germany." *SHS Web of Conferences* 63, 13002 (2019). MODSCAPES 2018. https://doi.org/10.1051/shsconf/20196313002

[161] United Nations Environment Programme, 2015 Germany Air Quality Policies, https://wedocs.unep.org/bitstream/handle/20.500.11822/17201/Germany.pdf?sequence=1&isAllowed=y

[162] European Court of Justice, European Commission v. Germany, Judgment in Case C-635/18, 3 June 2021.

throughout surrounding ecosystems, with devastating consequences for the main food source, livelihoods and health of the Asubpeechoseewagong people. In the words of Chief Simon Fobister Sr., "The story of my people, the Grassy Narrows First Nation, weighs heavily on the collective conscience of Canada. For over half a century, mercury poison has contaminated the river that is our lifeblood."[163] Studies in the area revealed concentrations of mercury 130 times higher than comparable river sections upstream. The average meal of fish (walleye) contained 15 times more than the acceptable daily limit of mercury for adults and 40 times the daily limit for pregnant women and children.[164] Nine out of ten members of the Asubpeechoseewagong First Nation experience symptoms of mercury poisoning, with very limited health resources for the devastated community.[165] Recent research finds that the high levels of mercury exposure among Asubpeechoseewagong individuals is linked to significantly shorter life expectancy.[166] The Governments of Canada and Ontario violated the Asubpeechoseewagong people's right to information by withholding or misrepresenting information about the extent and consequences of the mercury contamination, leading the community to continue using the contaminated water and eating contaminated fish.[167]

54. In 2017, the Government of Ontario established an $85 million trust to fund remediation of mercury contamination in the English and Wabigoon Rivers. In 2020, the Government of Canada announced a framework agreement with Asubpeechoseewagong Netum Anishinabek to build a care home to help community members affected by mercury. Canada also invested in water treatment infrastructure upgrades that ended all boil-water advisories affecting Grassy Narrows First Nation, finally ensuring the community's right to safe water.

Climate Crisis Sacrifice Zones

55. For a number of small island developing states (SIDS), including Antigua and Barbuda, Bahamas, Barbados, Cabo Verde, Comoros, Cuba, Dominica, Dominican Republic, Fiji, Grenada, Haiti, Jamaica, Kiribati, the Maldives, Marshall Islands, Mauritius, Micronesia, Nauru, Palau, Papua New Guinea, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Samoa, São Tomé and Príncipe, Seychelles, Solomon Islands, Timor-Leste, Tonga, Trinidad and Tobago, Tuvalu and Vanuatu, the climate crisis is creating a new category of sacrifice zones. Communities have been forced to relocate and, in some cases, entire countries are in jeopardy. In Fiji, the community of Vunidogaloa moved several kilometers inland from their previous waterfront location because salt water intrusion contaminated their drinking water and agricultural lands, rising sea levels were inundating houses and storm surges were increasingly dangerous. Dozens of additional communities in Fiji are on a waiting list to be relocated. In the United States, the community of Isle de Jean Charles (Louisiana) received a $US48 million grant to assist in relocation because of the combined impacts of sea level rise, coastal erosion, floods and hurricanes.

56. The geographical characteristics of some island States make their entire nations acutely vulnerable to tropical storms, cyclones, saltwater intrusion and rising sea levels. For example, the Maldives has an average elevation of less than 2m above sea level. A report by UNEP in 1989 warned that the Maldives urgently needed assistance to deal with the impacts

[163] Quoted in Mosa A, Duffin J. "The interwoven history of mercury poisoning in Ontario and Japan," *Canadian Medical Association Journal*. 2017; 189(5): E213-E215. doi:10.1503/cmaj.160943.

[164] Bruser, D., & Poisson, J. (2016 November 23). "Grassy Narrows residents eating fish with highest Mercury levels in province." *Toronto Star*. See: https://www.thestar.com/news/canada/2016/11/23/grassy-narrows-residents-eating-fish-with-highest-mercury-levels-in-province.html?rf

[165] Canadian Broadcasting Corporation (CBC), 2017, *Children of the poisoned river.* https://www.cbc.ca/news2/interactives/children-of-the-poisoned-river-mercury-poisoning-grassy-narrows-first-nation/

[166] Philibert A, Fillion M, Mergler D. "Mercury exposure and premature mortality in the Grassy Narrows First Nation community: a retrospective longitudinal study." *Lancet Planet Health.* 2020 Apr; 4(4): e141-e148.

[167] Human Rights Watch, 2016, *Make it Safe: Canada's Obligation to End the First Nations Water Crisis.*

of sea level rise and climate change.[168] The Maldives has built artificial islands and relocated people to them.[169] In many SIDS, a lack of potable water and a lack of arable land are exacerbated by the climate crisis, exemplified by the critical situation in Kiribati.[170] People do not want to leave their homes but increasingly feel as though they have no choice, despite the fact that they are in no way responsible for the climate crisis. During her visit to the Maldives, the Special Rapporteur on Cultural Rights was told by a 15 year-old activist: "I fear for the survival of my country."[171] Obviously no one, but particularly no young person, should have to face such fears.

Conclusion

57. **International human rights law obliges States to work towards achieving universal enjoyment of the right to a safe, clean, healthy and sustainable environment, without discrimination, using the maximum available resources, while prioritizing those most in need. Who are the people most in need? In the environmental context, the people "most in need" are those living in sacrifice zones, enduring the worst imaginable environmental conditions at great cost to their health, dignity, wellbeing and human rights. Sacrifice zones are frequently linked to poverty, race, and other factors that often intersect, making disadvantaged communities especially vulnerable**.

58. **The idea of 'leaving no one behind' is at the heart of the 2030 Agenda and the Sustainable Development Goals. These global initiatives seek to ensure that all people in all countries enjoy the full realization of their human rights. For example, States made the following commitment in 2019: "We will endeavour to reach the furthest behind first."[172] There can be no doubt that people living in sacrifice zones are the furthest behind, and therefore must be prioritized in policy-making and resource allocation.**

59. **People from different groups are 'left behind' for different reasons. Among the leading reasons are discrimination, exclusion, marginalization, entrenched power asymmetries and material inequalities. Poorly designed and inadequately implemented laws and policies, inefficient and improper use of financial resources, as well as policy gaps fuel persistent environmental injustices leading to sacrifice zones. Unless these root causes are addressed in both policy and practice, environmental and human rights interventions will continue to fail to reach those most in need.**

60. **Achieving environmental justice for all, through the recognition and implementation of the right to a safe, clean, healthy and sustainable environment is essential for rehabilitating sacrifice zones, eradicating poverty, building peaceful and prosperous societies, and ensuring that 'no one is left behind' on the journey towards sustainable development.**

[168] Sestini, G., & Pernetta, J. C. (1989). "The Maldives and the impact of expected climatic changes." *UNEP Regional Seas Reports and Studies NO. 104*, *104*. http://www.unep.org/regionalseas/publications/reports/RSRS/pdfs/rsrs104.pdf

[169] Brown, S., Wadey, M. P., Nicholls, R. J., Shareef, A., Khaleel, Z., Hinkel, J., Lincke, D., & McCabe, M. V. (2019). "Land raising as a solution to sea-level rise: An analysis of coastal flooding on an artificial island in the Maldives." *Journal of Flood Risk Management*, *13* (June 2019), 1–18.

[170] See *Teitiota v New Zealand*, CCPR/C/127/D/2728/2016 (7 January 2020).

[171] A/HRC/43/50/Add.2

[172] High Level Political Forum, 2019, Political declaration of the high-level political forum on sustainable development convened under the auspices of the General Assembly, A/HLPF/2019/L.1.

Appendix I. Contributors to research on sacrifice zones

The Special Rapporteur thanks the following contributors to the global online researchathon (including several classes of graduate students at the University of British Columbia) on non-toxic environments in which to live, work, study and play:

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