A Difficult Situation: the Potential Toxicity of Climate Change Solutions

Rehman Hassan [1 2 3 4 5] & Jad Abdelnour

[1] Adolescent Champion, Partnership for Maternal, Newborn, and Child Health, World Health Organization (WHO)

[2] Secretary, Child-Friendly Cities Initiative Houston Youth Council, United Nations Children's Fund (UNICEF)

[3] Young Champion, United Nations Refugee Agency (UNHCR)

[4] CEO & Founder, Cure Health International 501(c)(3)

[5] Representative & Young Ambassador at the United Nations, Citizen Outreach Coalition

Submitted on behalf of iCure Health International and the Citizen Outreach Coalition, an organization in consultative status with the United Nations Economic and Social Council

March 6, 2023

A Difficult Situation: the Potential Toxicity of Climate Change Solutions

Introduction

Climate change, today, remains the world's most urgent issue; in fact many have even expressed that it is the defining issue of the twenty-first century, impacting the experience of all people through changes in weather limiting food production or rising sea levels that have already impacted millions.[1] As such, and rightfully so, climate change solutions are at the forefront of innovation, to the point that there are prizes worth hundreds of millions of dollars for innovative and unique climate change solutions.[2] At the same time, however, climate change solutions can also cause significant damage and harm to individuals across the world, especially individuals from unserved communities and with diverse identities. Thus, during this time of increasing innovation surrounding the toxic implications of climate change, equally important is the critical investigation of existing and proposed climate change solutions to identify areas of concern.

Toxic Pollution Caused By Mineral Extraction Used in Climate Solutions

Many climate change solutions often employ toxic materials and minerals, often implicated in causing toxicity and other environmental concerns that play an important role in daily life. Often, climate change solutions that use batteries, such as electric vehicles, wind power, solar power, geothermal energy, and nuclear power demand the use of toxic and dangerous materials that not only impair the well-being of miners but also the environment as a whole and all those that miners and extractors may interact with.

Lithium-ion batteries play a critical role in the development of alternative sources of energy. Today, lithium and cobalt serve as critical elements of batteries used for electric vehicles, solar energy production, hydropower production, wind energy production, and sometimes in geothermal energy production. Lithium extraction is especially problematic, often occurring in low and middle-income countries by workers with extremely limited pay and terrible working

---

[1] "Climate Change - the United Nations." https://www.un.org/en/global-issues/climate-change. Accessed 15 Feb. 2023.

[2] "Who, what, where of Elon Musk's $100 million prize for carbon capture." 8 Feb. 2021, https://www.cnbc.com/2021/02/08/who-what-where-of-elon-musks-100-million-prize-for-carbon-capture.html. Accessed 6 Mar. 2023.

conditions.[3] This extraction often has toxic impacts on surrounding Indigenous communities and can lead to years of soil degradation, limited crop production for years to come;[4] water shortages, hurting the well-being of inhabitants; biodiversity loss, limiting population resilience, acid-mine drainage, contaminating downstream water sources and ecosystem health;[5] and a worsening of global warming.[6] Even worse is a key element of the mining process where brine is pumped from underground aquifers into large evaporation ponds, where they lay for years, which opens up the chance for contaminated aquifers, which will never recover. Moreover, many salts and other materials are left over, which can damage surrounding plants and hurt animals in the area.[7]

Cobalt, also used in the production of lithium-ion batteries, can also present a variety of different challenges and forms of toxicity. The Democratic Republic of Congo contains the largest cobalt reserves, producing 70% of the world's cobalt. However, cobalt mining in the region presents a serious challenge with many reports of serious human rights abuses, such as child labor, hazardous working conditions, and exploitation. In fact, Amnesty International reported in 2016 that roughly 20% of the cobalt mined in the DRC came from mines, where workers use hand tools to dig and extract minerals from the earth. These mines often lack proper ventilation, exposing employees to toxic substances like cobalt dust, which can cause respiratory issues. In addition, some cobalt mine workers received wages as low as $2 per day, far less than the poverty line.[8] The mining process also generates large volumes of trash, which can contaminate the environment. Furthermore, harmful chemicals like sulfuric acid, which can pollute the air and water, are used in the cobalt refining process.[9]

---

[3] "Cobalt mining for lithium ion batteries has a high human cost." 30 Sep. 2016, https://www.washingtonpost.com/graphics/business/batteries/congo-cobalt-mining-for-lithium-ion-battery/. Accessed 6 Mar. 2023.
[4] "The Lithium Gold Rush: Inside the Race to Power Electric Vehicles." 6 May. 2021, https://www.nytimes.com/2021/05/06/business/lithium-mining-race.html. Accessed 6 Mar. 2023.
[5] "Unit 2 Reading: Lithium and Cobalt Mining - SERC (Carleton)." 27 Aug. 2014, https://serc.carleton.edu/integrate/teaching_materials/mineral_resources/student_materials/unit2licoreading.html. Accessed 6 Mar. 2023.
[6] "South America's 'lithium fields' reveal the dark side of our electric future." 21 Nov. 2022, https://www.euronews.com/green/2022/02/01/south-america-s-lithium-fields-reveal-the-dark-side-of-our-electric-future. Accessed 6 Mar. 2023.
[7] "Can seawater give us the lithium to meet our battery needs? - C&EN." 28 Sep. 2021, https://cen.acs.org/materials/inorganic-chemistry/Can-seawater-give-us-lithium-to-meet-our-battery-needs/99/i36. Accessed 6 Mar. 2023.
[8] "“THIS IS WHAT WE DIE FOR” - Amnesty International." https://www.amnesty.org/en/wp-content/uploads/2021/05/AFR6231832016ENGLISH.pdf. Accessed 6 Mar. 2023.
[9] "Cobalt Mining: The Dark Side of the Renewable Energy Transition." 27 Sep. 2022, https://earth.org/cobalt-mining/. Accessed 6 Mar. 2023.

Also commonly used in the manufacturing process for many climate change solutions are rare earth metals such as neodymium, dysprosium, and praseodymium, especially in the production of wind turbines and electric vehicles. The mining process for these rare earth metals releases various pollutants into the environment; one especially significant example is the Bayan Obo mine in China, the world's largest rare earth metal mine, whose processes release a significant amount of wastewater that can be almost impossible to clean. As a result, the surrounding soil and water resources can become contaminated by this discharge, primarily impacting women and children for generations to come.[10]

Another hazardous and toxic pollutant is uranium, which is the most crucial element of modern nuclear power production. Nuclear energy is incredibly effective at producing high levels of energy with little to no input in a carbon-free way; however, the uranium used in production can often be extremely dangerous and have significant impacts on surrounding areas, especially if not contained well. Often the uranium mining process releases large levels of radioactive waste that do not become safe for up to billions of years. [11] Moreover, the burden of uranium mining is often placed on Indigenous communities, which can face health, environmental, and agricultural effects forever as a result. For example, the Navajo Nation in the United States has experienced severe health problems due to uranium mining, such as kidney disease, lung cancer, and other illnesses. In the long run, uranium can poison potable water supplies, limit crop growth, degrade soil, and permanently degrade aquifers.[12] [13] The communal effects of such toxins can be especially damaging as they could result in the loss of traditional knowledge and cultural legacy.

Biomass Consequences the following has been adapted from a paper by Hassan et. al. with prior and informed consent[14]

---

[10] "Can seawater give us the lithium to meet our battery needs? - C&EN." 28 Sep. 2021, https://cen.acs.org/materials/inorganic-chemistry/Can-seawater-give-us-lithium-to-meet-our-battery-needs/99/i36. Accessed 6 Mar. 2023.
[11] "Radioactive Waste From Uranium Mining and Milling | US EPA." 29 Jul. 2022, https://www.epa.gov/radtown/radioactive-waste-uranium-mining-and-milling. Accessed 6 Mar. 2023.
[12] "Uranium mining and health - PMC - NCBI." https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3653646/. Accessed 6 Mar. 2023.
[13] "Potential Environmental Effects of Uranium Mining, Processing, and ...." https://www.ncbi.nlm.nih.gov/books/NBK201052/. Accessed 6 Mar. 2023.
[14] "Youth and Adolescent Recommendations on Issues of Technology and Innovation: A Focus on Biomass Cooking."

According to the World Health Organization, 2.4 billion people worldwide, or roughly a third of the world's population, cook or bake food items using dangerous open fires or inefficient stoves, which are often fueled by wood, animal waste, agricultural waste, coal, or kerosene. Although often lauded as healthy and sustainable methods of fuel production, biomass uses of fuel can be extremely dangerous. These fuel sources often lead to the release of pollutants such as particulate matter, which can harm human health by causing bronchitis, exacerbating diseases, or hindering the well-being of other organisms such as by limiting photosynthesis. This fuel, especially when using animal dung, can cause infections such as those caused by *Escherichia coli*, *Cryptosporidium spp*, and *Entamoeba histolytica*. Moreover, open fires and the combustion of these fuel sources can lead to the release of carbon monoxide, black carbon, methane, nitrogen oxides, and VOCs, which can exacerbate climate change, economic markets, social interactions, and overall well-being. From an environmental perspective, the heavy use of biomass may lead to deforestation and desertification. As more and more trees are cut down to meet the demand for fuel, natural habitats are destroyed and biodiversity is reduced. Moreover, it is often women and children using these sources who often face the largest consequences from extensive exposure to these harmful substances, often being diagnosed with respiratory diseases and infections because of the handling of animal wastes.

Moreover, ethanol and biodiesel, although renewable, often harm the environment, such as through the deforestation of large areas of tropical rainforests for palm oil extraction, affecting the natural habitat of several plant and animal species. Furthermore, because trees store carbon, their removal can cause vast carbon emissions into the atmosphere, significantly impacting the climate. To continue, often the use of these large-scale monoculture farming practices to grow crops for biofuel production can result in the displacement of local communities and Indigenous people and biodiversity loss.

Conclusion

It is crucial to be aware of the potential drawbacks of the compounds used to combat climate change and work toward sustainable solutions that cause the least harm to the environment and

---

https://docs.google.com/document/d/1wcX4G0TxomZ-ISzI3FrCkS6Fkz7NrwoT_pJT0uPLDmA/edit?usp=sharing. Accessed 6 Mar. 2023.

to people's health, especially in vulnerable populations. The manufacturing and disposal of these compounds can be better regulated and supervised, and alternative, more sustainable materials can be adopted as part of these efforts. Decision-making processes involving using natural resources on their lands should also include local communities and Indigenous peoples to guarantee that their rights and interests are respected and maintained.

As part of a larger effort to advance social and environmental justice, tackling the detrimental effects of hazardous compounds in climate change solutions should be an immediate priority. Recognizing how vulnerable groups are disproportionately impacted by environmental degradation and climate change and working to ensure they have access to the resources and support they require to adapt and prosper are crucial to address these consequences.