Climate Smart Sanitation

Submission for Consideration of the Sharm el-Sheikh Mitigation Ambition and Implementation Work Programme

March 28th, 2024

Introduction

This submission is made by United Nations Children's Fund (UNICEF) on behalf of Climate Resilient Sanitation (CRS) Coalition[1]. In line with the Sharm el-Sheikh Mitigation Ambition and Implementation Work Programme's focus on *Cities: buildings and urban systems*, and in relation to the call for parties and observers to submit via the UNFCCC submission portal by 31 March 2024 views on opportunities, best practices, actionable solutions, challenges and barriers relevant to the topics of the dialogues, this short paper brings to the attention of parties that climate smart sanitation systems presents both an untapped opportunity and an actionable solution for reducing carbon emissions in urban areas.

The Relationship between mitigation and sanitation

The WHO/UNICEF Joint Monitoring Programme reports that 3.5 billion people still lacked safely managed sanitation in 2022 and the world is off track towards achieving the sanitation sustainable development goal related targets (i.e., SDG6.2 targets). Achieving universal sanitation coverage by 2030 requires a **five-fold increase** for safely managed sanitation.

Poorly managed sanitation primarily emits three types of greenhouse gasses (GHG): methane (CH_4) and nitrous oxide N_2O[2], which have global warming potentials 25 and 300 times greater (respectively) than carbon dioxide[3]. They are directly produced from faecal matter as a result of anaerobic processes. Carbon dioxide (CO_2) is also produced from aerobic processes (e.g., using oxygen during wastewater treatment), but is less impactful due to the stronger climate-changing nature of methane and nitrous oxide (Table 1).

Table 1 Emissions from sanitation systems

Direct	Gasses produced from the system	• CH_4 and N_2O from contents of pits, tanks and sewers • CH_4 and N_2O from treatment plants
Operational	Gasses produced from burning fossil fuels	• CO_2 from burning fuel for pumping or trucking faecal waste. • CO_2 from use of energy input to treatment plants
Embedded Carbon	Carbon produced during production of WASH assets	• Concrete and steel in infrastructure • CO_2 associated with production and use of chemicals

[1] Coalition members include African Development Bank, Asian development Bank, Bill and Melinda Gates Foundation, Container Based Sanitation Alliance, Faecal Sludge Management Alliance, Green Climate Fund, Global Green Growth Institute, GIZ, iDE, Lixil, Practical Action, PSI, Resilient Cities Network, Stockholm Environment Institute, SNV, Sanitation and Water for All, University of Bristol, University of Leeds, University of Technology Sydney, UN Habitat, USAID, Water for Women, WaterAid, Wildlife Conservation Society, WHO, World Bank, and Water and Sanitation for the Urban Poor.

[2] Reid, MC et al. 'Global methane emissions from pit latrines', Environmental science & technology, vol. 48,15 (2014): 8727-34.

[3] https://www.epa.gov/ghgemissions/overview-greenhouse-gases

Sanitation and wastewater management systems are categorized within the "waste" sector, whereby methane emissions from wastewater management (primarily those systems using water-borne sewers), are estimated to account for 7% of global methane emissions[4], and the rest of sanitation may account for another 5%[5] and have ~0.04°C climate forcing effect.

However, existing GHG emission inventories likely underestimate methane emissions from the sanitation sector due to limited empirical data on the scale of emissions from non-sewered sanitation[6] (i.e., pit latrines, septic tanks, and other technologies common to urban areas), as well as other aspects of urban sanitation systems, including the emptying and transport services and disposal of sewage sludge.

Sanitation's GHG emissions are becoming more pronounced as more people now use on-site sanitation facilities than sewer connections. Since 2000, 1.3 billion people have gained access to sewer connections, compared with 1.9 billion who have gained access to improved on-site sanitation facilities; and on-site sanitation has increased faster than sewered sanitation in urban areas[7]. The findings from a recent study and analysis of emissions from all stages of the sanitation service chain in Kampala, Uganda calculates that sanitation produces over 50 per cent of the city's total emissions[8].

Addressing methane emissions from sanitation directly supports the Global Methane Pledge to cut methane emissions by 30% by 2030. The sanitation and wastewater sector alone can contribute 5-7% of that reduction.

Additionally, sanitation systems damaged by climate events disrupt ecosystems' ability to sequester carbon. For example, seagrass beds sequester CO_2 35x faster than rainforests and account for ~15% of total ocean carbon storage; 88% of seagrass ecosystems are exposed to wastewater[9].

Key urban mitigation strategies for GHG emissions from sanitation

Fortunately, we know the solution to cutting GHG emissions from sanitation. The findings from all the latest research show that:

Promotion of Actively Managed Sanitation. Reducing emissions from sanitation in urban settings is not about technologies but about systems. Current management approaches for sanitation systems in many urban settings of low- and middle-income countries lead to significant emissions of GHGs, with most emissions coming from storage, treatment and informal discharges of faecal sludge or wastewater. Reducing emissions from on-site sanitation systems can be effectively achieved by putting mechanisms in place for quick removal, transport, and treatment of faecal waste, as well as regular maintenance of the infrastructure. This requires supporting unserved populations, especially the most vulnerable

[4] Global Methane Initiative. Global Methane Emissions and Mitigation Opportunities.
[5] Cheng, S., et al. 'Non-negligible greenhouse gas emissions from non-sewered sanitation systems: A meta-analysis' Environmental Research, Volume 212, Part D, 2022. https://www.sciencedirect.com/science/article/pii/S0013935122007952
[6] Lambiasi, L., Ddiba, D., Andersson, K. Parvage, M., Dickin, S. Greenhouse gas emissions from sanitation and wastewater management systems: a review. IWA. 2024
[7] United Nations Children's Fund (UNICEF) and World Health Organization (WHO), 2023: Progress on household drinking water, sanitation and hygiene 2000–2022: special focus on gender https://washdata.org/reports/jmp-2023-wash-households
[8] Johnson, J. et al. 'Whole-system analysis reveals high greenhouse-gas emissions from citywide sanitation in Kampala, Uganda', *Commun Earth Environ* 3, 80 (2022).
[9] Tuholske C, Halpern BS, Blasco G, Villasenor JC, Frazier M, Caylor K (2021) Mapping global inputs and impacts from of human sewage in coastal ecosystems. PLoS ONE 16(11): e0258898. https://doi.org/10.1371/journal.pone.0258898

and those living in high-risk climate impacted areas, to have access to safely managed and climate resilient sanitation.

Promoting energy efficiency and reuse of wastewater. Integrating energy efficiency and incorporating the use of renewable energy throughout the urban sanitation service chain can have significant impact on reducing emissions from sanitation systems. Maximizing the opportunities of recycling wastewater for different purposes such as irrigation and groundwater recharge also support mitigation efforts. In addition, promoting energy and resource efficiency in the transportation of the faecal sludge to treatment facility as part of the overall efforts of accelerating just energy transition in transport systems will contribute to reducing emissions in most cities of LMICs.

Conclusion

Achieving the Paris Agreement of limiting global warming increase to 1.5°C cannot be realized without due attentions to emissions from sanitation systems along the entire service chain (both sewered and non-sewered). And cities are where the greatest impact can be achieved.

Current evidence has shown that sanitation is much more important in terms of emissions than we previously thought, hence the need to support actions that will promote actively managed sanitation, energy efficiency and wastewater reuse. This will involve:

- Sustained advocacy and awareness creation at global and country levels on the interrelationship between climate change and sanitation; and the opportunities of reducing GHG emissions from sanitation systems.
- Enhanced sector capacity on appropriate and innovative sanitation solutions for reducing GHG emissions.
- Strengthening evidence on sanitation's contribution to GHG emissions
- Mainstreaming climate resilient sanitation including mitigation in national policies, plans and budgets; and
- Mobilizing investments for promotion of green sanitation infrastructure.

This joint submission therefore recommends that Sharm el-Sheikh Mitigation Ambition and Implementation Work Programme incorporates the elements of mitigating GHG emissions from sanitation systems as part of the topics to be discussed at the global dialogues in 2024. The Climate Resilient Sanitation Coalition, authoring this submission, is willing to provide additional technical support related to Sanitation as part of the 2024 technical discussions of the Mitigation Work Programme.

Annex 1: Further Reading

1. Unlocking carbon credits for sanitation, CBSA, September 2023
2. Johnson, J., Zakaria, F., Nkurunziza, A.G. *et al.* Whole-system analysis reveals high greenhouse-gas emissions from citywide sanitation in Kampala, Uganda. *Commun Earth Environ* 3, 80 (2022). https://doi.org/10.1038/s43247-022-00413-w
3. Dickin, S., Bayoumi, M., Giné, R. *et al.* Sustainable sanitation and gaps in global climate policy and financing. *npj Clean Water* 3, 24 (2020). https://doi.org/10.1038/s41545-020-0072-8
4. Sanitation and climate: assessing resilience and emissions (SCARE)
5. Climate and Costs in Urban Sanitation (CACTUS)