Sanitation Submission for Consideration of the Sharm el-Sheikh mitigation ambition and implementation work programme

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Introduction

This submission is made by United Nations Children's Fund (UNICEF) on behalf of Climate Resilient Sanitation (CRS) Coalition with inputs from the 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, Water Initiative for Net Zero, World Bank, and Water and Sanitation for the Urban Poor.

In line with the scope of work of the Sharm el-Sheikh Mitigation Ambition and Implementation Work Programme, and in relation to the call for submissions by parties and observers to submit via the UNFCCC submission portal by 1 February 2024 suggested topics for the global dialogues in 2024, this short paper aims at bringing to the attention of parties that climate resilient sanitation systems remain an untapped opportunity, and have a great potential of contributing to reduction in carbon emissions.

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 will require a **five-fold increase** for safely managed sanitation.

Achieving universal access to safely managed sanitation is further undermined by the impact of climate change along the entire sanitation service chain. At the same time, poorly managed sanitation contributes to GHGs through the breakdown of excreta to methane, transportation emissions, and the energy required for treatment.

The current management approaches for sanitation systems in most 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. This is becoming more pronounced as more people are now using improved 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 both rural and urban areas[1].

Emissions from sanitation systems are often underestimated, and global estimates do not always consider the non-sewered sanitation systems which are prevalent in rapidly growing cities in low-and middle-income countries (Table 1).

[1] 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

Table 1: Emissions from sanitation systems

Direct	Gasses that are 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

While data on the sanitation-related emissions of GHGs are limited (but growing), a 2022 report estimates that global methane emissions from non-sewered sanitation systems are equivalent to approximately 377 metric tons of carbon dioxide equivalent per year, **or 4.7 per cent of global anthropogenic methane emissions**[2] which are comparable to emissions from wastewater treatment plants and **has about 0.04°C climate forcing effect**. In 2019, the US Environmental Protection Agency estimated that GHGs emitted by wastewater treatment plants would amount to 632 metric tons of carbon dioxide per year in 2020[3].

Methane and nitrous oxide are the most significant GHGs emitted by sanitation systems[4], and have global warming potentials 25 and 300 times greater (respectively) than carbon dioxide[5]. They are directly produced from faecal matter as a result of anaerobic processes. Carbon dioxide 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.

The findings from a recent study and analysis of emissions from all stages of the sanitation service chain in Kampala, Uganda shows that sanitation produces 189 kilotons of carbon dioxide equivalent annually, which represented over 50 per cent of the city's total emissions6. Methane from anaerobic parts of the sanitation system (storage in pits and tanks, illegal dumping, treatment) is the major contributor to overall emissions. In 2021, the Intergovernmental Panel on Climate Change (IPCC) called for methane to be urgently tackled.

Urban sanitation systems in cities in most low- and middle-income countries are complex and partially decentralized and fragmented systems dominated by faecal sludge management (FSM) which rely on onsite containment with manual or mechanical emptying and road-based

[2] 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
[3] United States Environmental Protection Agency, 'Global Non-CO2 Greenhouse Gas Emission Projections & Mitigation: 2015–2050', Washington. DC: USEPA.2019/
[4] Reid, MC et al. 'Global methane emissions from pit latrines', Environmental science & technology, vol. 48,15 (2014): 8727-34.
[5] https://www.epa.gov/ghgemissions/overview-greenhouse-gases
[6] Johnson, J. et al. 'Whole-system analysis reveals high greenhouse-gas emissions from citywide sanitation in Kampala, Uganda', *Commun Earth Environ* 3, 80 (2022).

conveyance of faecal sludge to a treatment facility[7]. Although, the emissions from transportation of the faecal sludge to treatment facility is still relatively low compared to those from containment and treatment, this is expected to increase with more cities in LMICs implementing FSM projects. USAID's recent study reported that, "[*I]t is estimated that both sewered and unsewered sanitation systems in urban sub-Saharan Africa (excluding South Africa) contributed 3.1 percent to 4.9 percent to the region's total annual anthropogenic methane emissions in 2020 - comparable to sectors like rice cultivation and coal mining. By 2030, this is projected to grow to 8 percent of the projected total annual methane emissions."*[8]

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].

Despite the demonstrated impact of sanitation on GHG emissions, as of 2020 only 2% of NDCs included sanitation[10].

As we look for solutions to reduce the emissions from containment and treatment, it will also be strategic to incorporate energy and resource efficiency in the transportation systems for the FSM projects as part of the overall efforts of reducing emissions from sanitation systems along the service chain.

The findings from all the latest research show that:

- Sanitation is much more important in terms of emissions than we previously thought.
- The current management approaches for sanitation systems in most 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.
- Total GHG emissions from urban sanitation systems are significant, perhaps as much as half of a city's emissions.
- Reducing emissions from sanitation is not about technologies but about systems.
- Reducing emissions from on-site facilities is about **Actively Managed Sanitation** – moving faecal waste quickly and maintaining infrastructure- both of which are also good for resilience.

Key mitigation strategies for GHG emissions from sanitation

Promotion of Actively Managed Sanitation. As we make progress towards achieving the SDG6.2 target of universal access to sanitation, efforts should be made to maximize opportunities for mitigation by reducing GHG emissions especially from on-site sanitation systems. Reducing emissions from on-site sanitation systems can be effectively achieved by putting mechanisms in place for quick removal of faecal waste and regular maintenance of

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[7] Leonie Hyde-Smith, Zhe Zhan, Katy Roelich, Anna Mdee, and Barbara Evans: *Climate Change Impacts on Urban Sanitation: A Systematic Review and Failure Mode Analysis. Environmental Science & Technology* **2022** *56* (9), 5306-5321 DOI: 10.1021/acs.est.1c07424 https://www.researchgate.net/publication/359923108_Climate_Change_Impacts_on_Urban_Sanitation_A_Systematic_Review_and_Failure_Mode_Analysis

[8] USAID Urban Resilience by Building and Applying New Evidence in Water, Sanitation, and Hygiene (URBAN WASH). 2023. Managing the climate impact of human waste. Washington, D.C. USAID URBAN WASH Project.

[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

[10] 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

the infrastructure- both of which are also good for resilience. This will require supporting the un-served population especially the most vulnerable and those living in high-risk climate impacted areas to have access to safely managed and climate resilient sanitation. This is good for both mitigation and adaptation.

Promoting energy efficiency and reuse of wastewater. Integrating energy efficiency and incorporating the use of renewable energy throughout the 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 will support both the mitigation and adaptation 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). 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 is therefore recommending that Sharm el-Sheikh Mitigation Ambition and Implementation Work Programme considers the various 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)