The climate and sanitation puzzle

Professor Barbara Evans, University of Leeds
Sanitation systems and services fail due to extreme weather.

Climate Change and Sanitation

- Sanitation systems produce greenhouse gases.
- Changing climate.
- Extreme weather events.
- Changing GHG profile.
Climate Change and Sanitation

Mitigation – to reduce emissions

Fewer extreme weather events

Adaptation – to reduce vulnerability

Less impact on climate

Reduced GHG profile
Mitigation

How big are emissions and where are they occurring?
What are the emissions from sanitation systems?
<table>
<thead>
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<th>What are the emissions from sanitation systems?</th>
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**Direct**

Gasses that are produced from the system

- CH₄ and N₂O from contents of pits, tanks and sewers
- CH₄ and N₂O from treatment plants
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## What are the emissions from sanitation systems?

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
<th>Examples</th>
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<td>Direct</td>
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<td>- CH₄ and N₂O from treatment plants</td>
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<tr>
<td>Operational</td>
<td>Gasses that are produced from burning fossil fuels</td>
<td>- CO₂ from burning fuel for pumping or trucking feecal waste</td>
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<td>- CO₂ from use of energy input to treatment plants</td>
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<td>Embedded Carbon</td>
<td>Carbon that is produced during the production of the assets of WASH</td>
<td>- Concrete and steel in infrastructure</td>
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<td>- CO₂ associated with production and use of chemicals</td>
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Onsite and offsite systems

Containment, Emptying, Transport & Treatment

Direct, Operational, Embedded Carbon
Direct emissions from pits and tanks were modelled on a ‘population’ scale from empirical data.
Wet anaerobic systems have the highest emissions.

Our estimates are more realistic than IPCC.
Operational emissions from trucks were MUCH lower than we expected.

*Also true for treatment and sewerage pumps.

Linear distance of FSM trucks (Schoebitz et.al. 2017)
Treatment processes have the highest per capita emission rates.

Direct methane accounts for the highest share of emissions for all systems.
Different sanitation pathways have different per capita emission rates
‘Onsite/ FSM’ systems are not inherently better or worse than offsite/ sewer systems.
'Safely managed' sanitation pathways do not have inherently lower per capita emission rates.
Total emissions dominated by storage, treatment and informal discharges.
Figure 7. Nationwide CH$_4$ emissions from the U.S. wastewater sector. (A) Estimated annual mean (±s.d.) CH$_4$ flux of each group and (B) accumulative probability of CH$_4$ emissions from the whole wastewater sector.
Global methane emissions from onsite containers 2020

• 377 (22–1,003) Mt CO\textsubscript{2}e/year
• 4.7% (0.3%–12.5%) of anthropogenic methane emissions
• Comparable to emissions from wastewater treatment plants.
• Significant in India, Indonesia, China, USA....
Mitigation

What might this mean for Implementation?
Total emissions dominated by storage, treatment and informal discharges.
Greenhouse gas emissions along the sanitation value chain are dynamic and interrelated – the best interventions are context specific.

Reducing emissions is associated with management of storage systems onsite – including pits and tanks – but also management of super-natant, or the liquid fraction.

Being thoughtful about treatment – thinking about end products (including biogas/ methane) and designing treatment appropriately.
Methane from anaerobic parts of the system (storage in pits and tanks, illegal dumping, treatment), is the major contributor to overall emissions

Reducing emissions for sanitation NOT about specific technologies (ie onsite versus sewers) but about systems

Reducing emissions IS about ‘actively-managed WASH’ - moving fecal waste quickly and maintaining infrastructure – both of which are also good for resilience
Thankyou