What Happens When the Pit is Full?

Developments in on-site Faecal Sludge Management

14-15 March 2011

Garden Court Marine Parade Hotel, Durban, South Africa

The Future of On-Site Sanitation

beyond the cesspit

Chris Buckley
Pollution Research Group
University of KwaZulu-Natal

buckley@ukzn.ac.za

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Bill and Melinda Gates Foundation
Reinvent the toilet challenge

- a stretch target
- economies of scale
  - (2.6 billion people without access to sanitation)
- full economic costing of the system
- provide up-front funding for concept, demonstration and tooling
- target cost
  - less than USD 0.05 per person . day (developing countries)
  - market prices (developed countries)

Reinvent the toilet such that sewers are not required. Chemical engineers could make a killing and a living in this if they're able to get over the fact that it's not sexy.

Frank Rijsberman
(Director of Water, Sanitation & Hygiene
Bill & Melinda Gates Foundation)

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What is Excreta?

- People excrete less than they take in as food and drink
- ~1.5 L/d nearly sterile urine
  - ~1.4% inorganic electrolyte (Na, K, Cl, SO_4Mg, P …
  - ~1.3% urea
  - ~0.54% organics + 0.4% organic ammonia salts
  - ~3.8 MJ to evaporate to dryness
  - **0.135 MJ** with multistage flash evaporation
- ~0.4 kg/d faecal paste
  - 0.3% (mostly non-viable bacteria), 10–20% lipids, 10-20% inorganics, 2-3% proteins, ~30% undigested fibre
  - some digestive residuals and GI shed-epithelium, trace amounts of virus, hormones, antibiotics …
  - 0.1 kg dry mass
  - **0.400 MJ** heat of oxidation

What can we do with it?

- water can be evaporated
- organics can be oxidised to CO_2, H_2O, N_2 and SO_2
  - resulting in 14 g /d residual salt
  - heat of oxidation appears to be ample to flash distil excrement's entire water fraction

people need the water to drink and the minerals lost to urine!

Even more …

- other waste could be added to provide additional energy
  - fuel cells
  - light

water borne sanitation is an historical artefact

due to ignorance about the cause of disease

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Water Flush and Sewers a dead end technology?

- can we envisage sanitation without flush water and sewers?
- what technology do we install now?
- what is the upgrade trajectory?
- can we afford to wait ?

Don't make perfect the enemy of good

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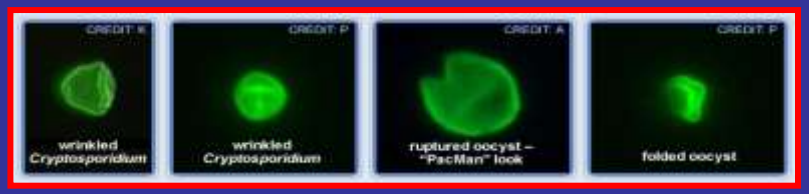
What else is in excreta …

Taenia sp.

Trichuris trichuria

Giardia:

Cryptosporidium:



Ascaris

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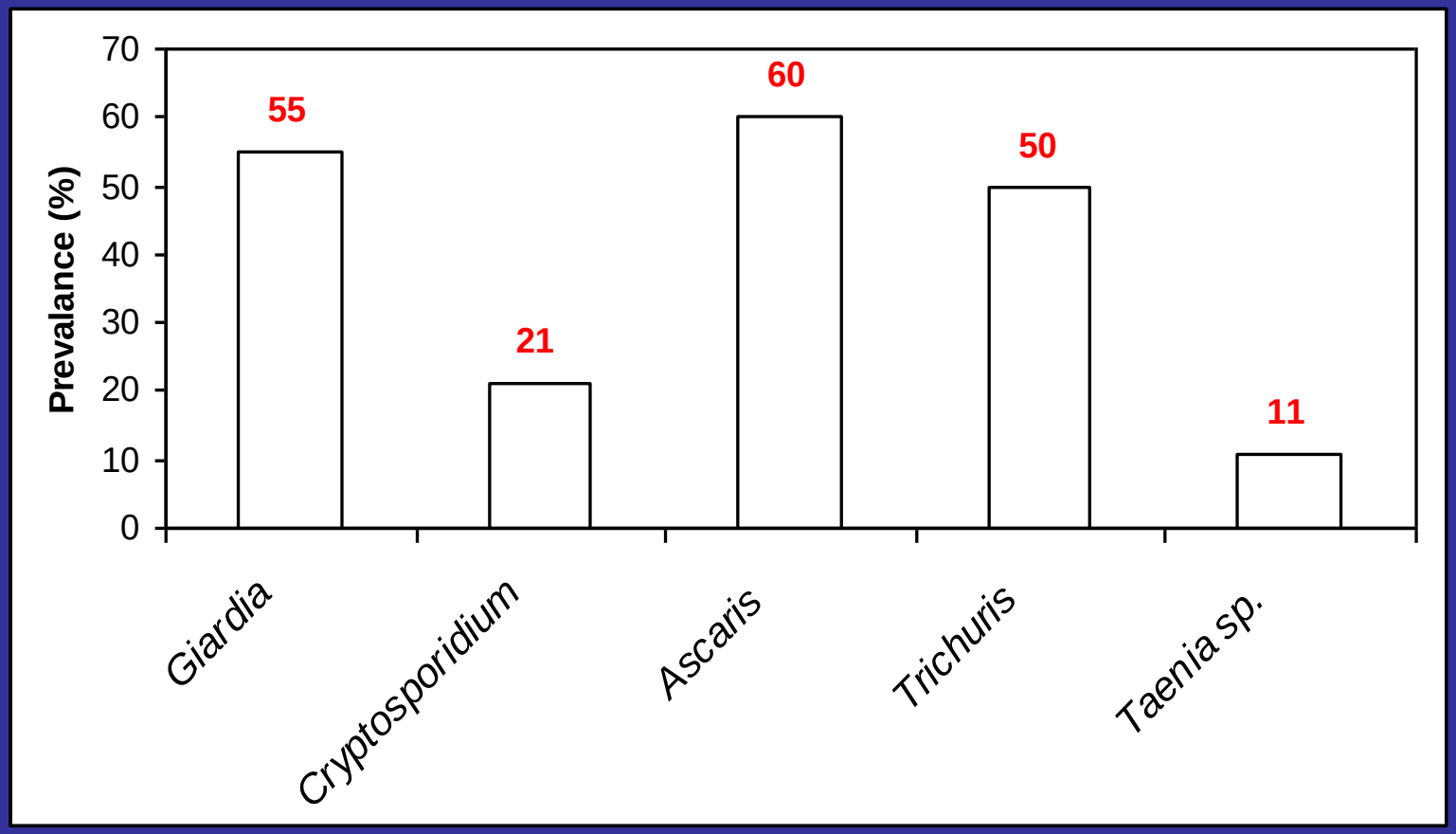
Prevalence of helminth and protozoan parasitic infections



D Hawksworth, C Archer, A Hanssen, L Trönnberg , R Lutchminarayan , S Knight , M Smith and N Rodda. WISA Conference Sun City 2008

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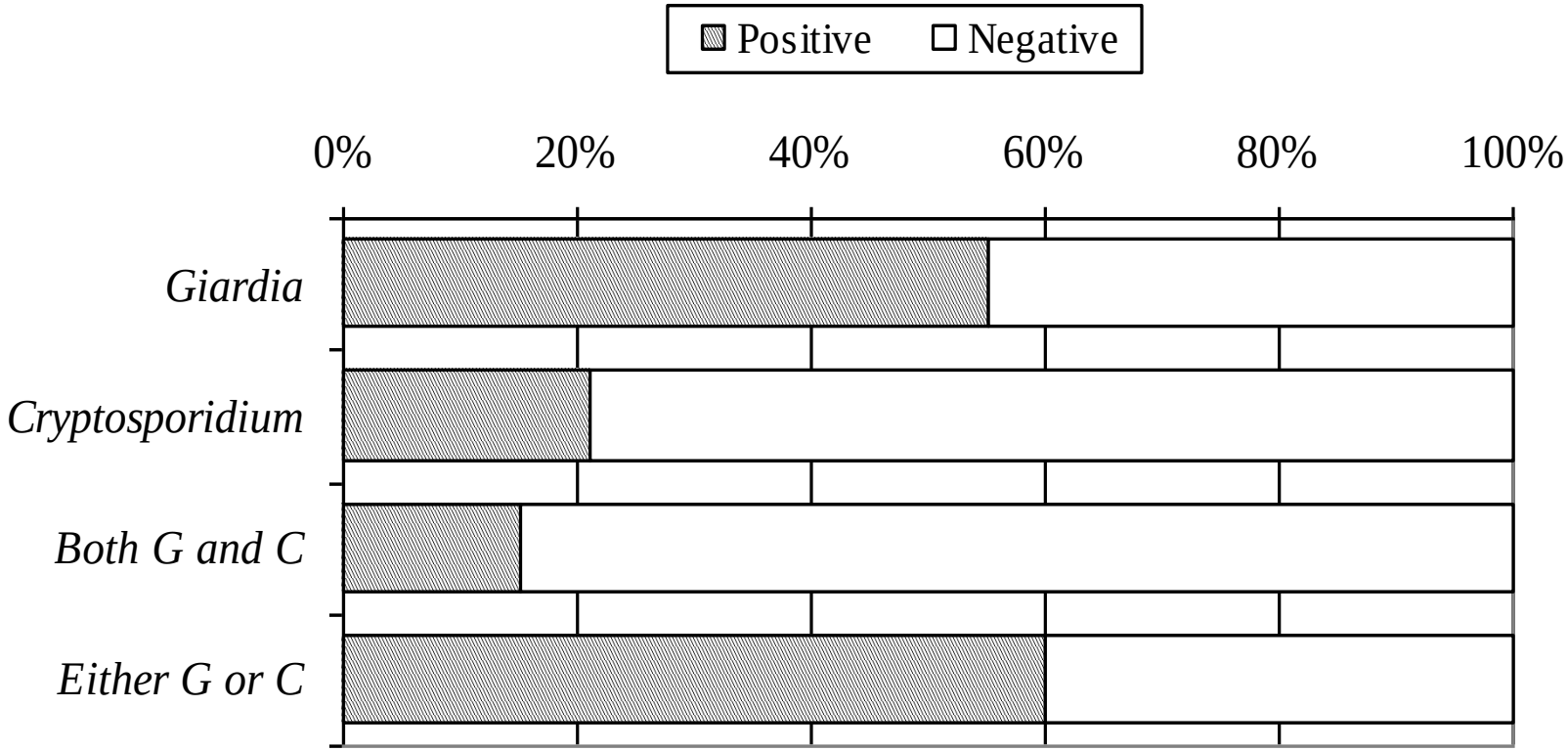
Protozoan parasitic infections



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Urine Diversion

rural

- smaller quantities to handle
- dry (lower mass)
- no odour
- household centred sludge disposal

urban

- not suitable for dense settlements
- institutional sludge disposal

still need to manage grey water

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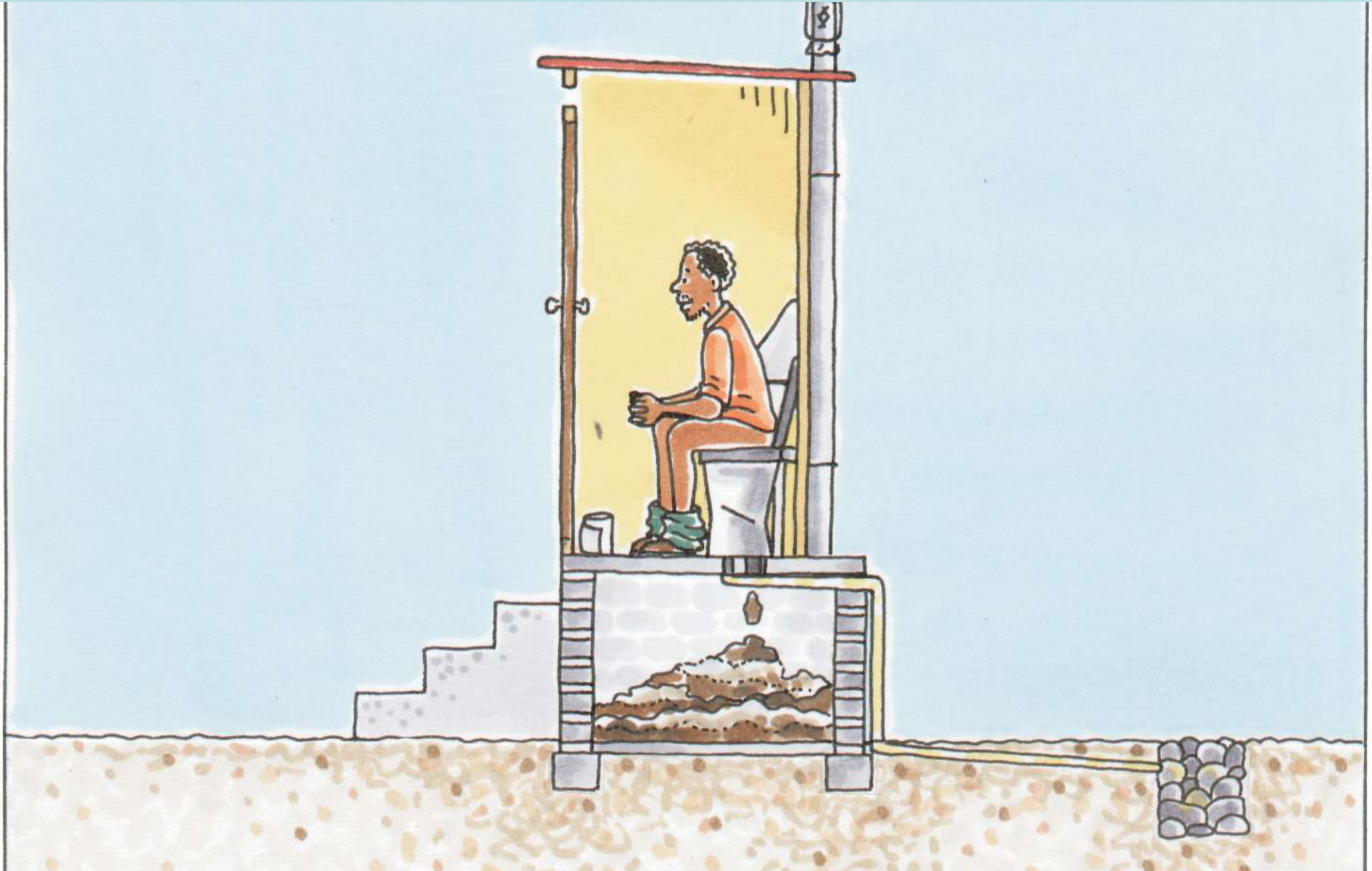
Urine Diversion Toilet



Vent-pipe with fly- screen

Double above-ground vault

Sliding door access to vault

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Incentivise use of UD toilets
by adding value to urine

- separate and concentrate nutrients from urine
- Bill and Melinda Gates Foundation project
  - Eawag
  - eThekwini Water and Sanitation
- recover products containing
  - nitrogen
  - phosphorous
  - potassium
- field trials in Durban

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Can VIPs be improved?

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Effective Solid Waste Removal

- after 10 years pits contain about 25% non-faecal material
- proportion increases with pit age
- with no rubbish addition pit life can be extended by about 75% (to 23 years)

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Post Emptying Waste Handling

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Extend the Life at the Bottom of a Pit

- 0.4 kg/d faecal paste
  - 0.3% (mostly non-viable bacteria),
  - 10–20% lipids,
  - 10-20% inorganics,
  - 2-3% proteins,
  - ~30% undigested fibre
- ***enzymes*** to degrade fibre and cell walls

increase pit life from 5 years to 50 years

London School of Hygiene and Tropical Medicine,
Bill and Melinda Gates Foundation grant

Post Christchurch Earthquake

www.showusyourlongdrop.co.nz/

This website has been set up to showcase all the creative Long Drops that are popping up around Christchurch. There are over 100 Long Drops already.

Voting closes **Monday 14th March 2011 at 7pm**.

- *Just a coupla retreads and some plastic.*

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