

The Next Generation Beyond Faecal Sludge Management: Seeing the Donut and the (W)hole

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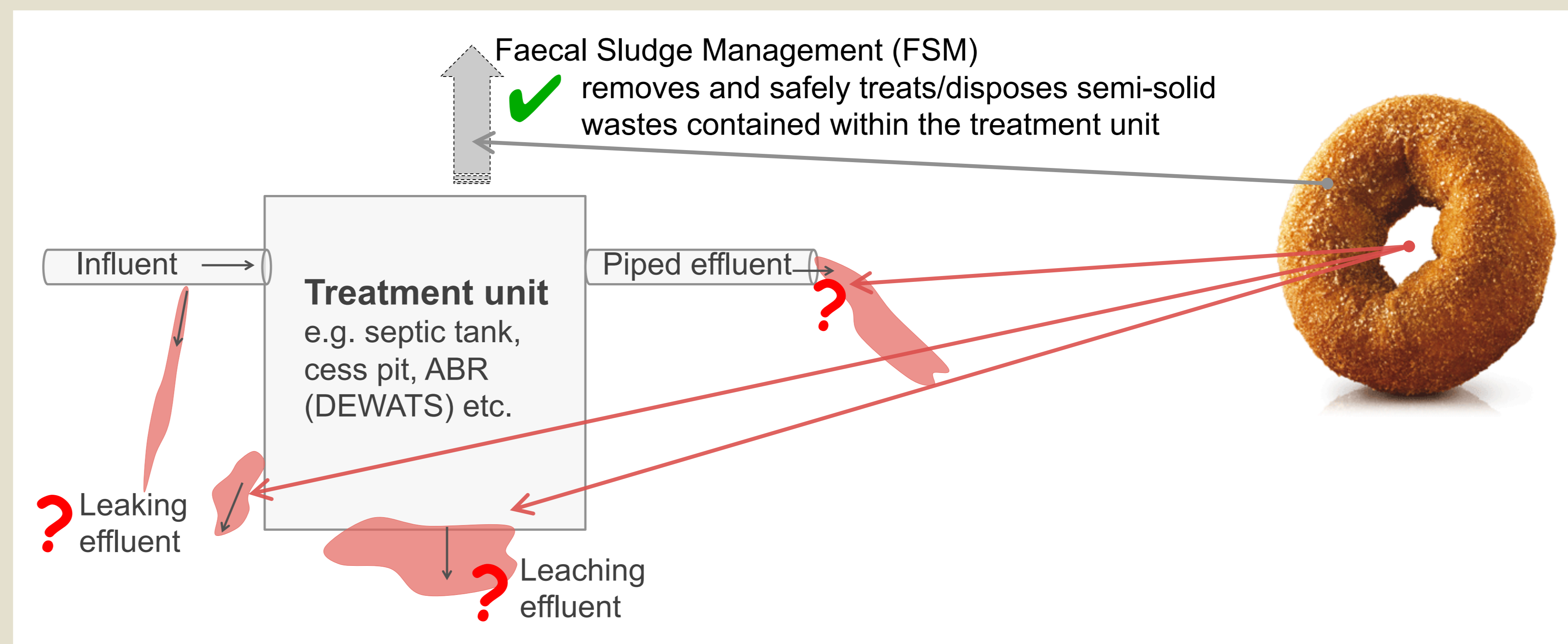


Headlines

- Our basic wastewater treatment technologies are not very good at removing disease-causing pathogens.
- The liquid effluent leaving common treatment systems can have hazardous levels of pathogens.
- Liquid effluent discharged to the environment is currently largely unnoticed and unmanaged.
- The Pathogen Hazard Diagram is a first principles thinking tool for paying attention to this potential hazard from common wastewater treatment systems.
- The tool may be used at the national or local scale to guide investments in new sanitation systems and refurbishments of existing technologies, so that the goal of sanitation is achieved: namely to reduce public health risks by separating faecal pathogens from people.

The situation

There are two kinds of 'products' from wastewater treatment. Both need attention:
(1) faecal sludge accumulating within the treatment unit (which receives periodic attention)
(2) liquid (effluent) leaving the treatment unit on a daily basis (which receives little/no attention)



Introducing the Pathogen Hazard Diagram

We need a tool to help us understand the levels of pathogens that may pass through wastewater treatment processes and end up where people can be exposed.

We have very little reliable location-specific pathogen data, because measuring and monitoring pathogens is complex, expensive and technically difficult.

The Pathogen Hazard Diagram is offered as a simple thinking tool that relies on first principles and text-book data (where measured pathogen data is unavailable) to assess hazards locally.

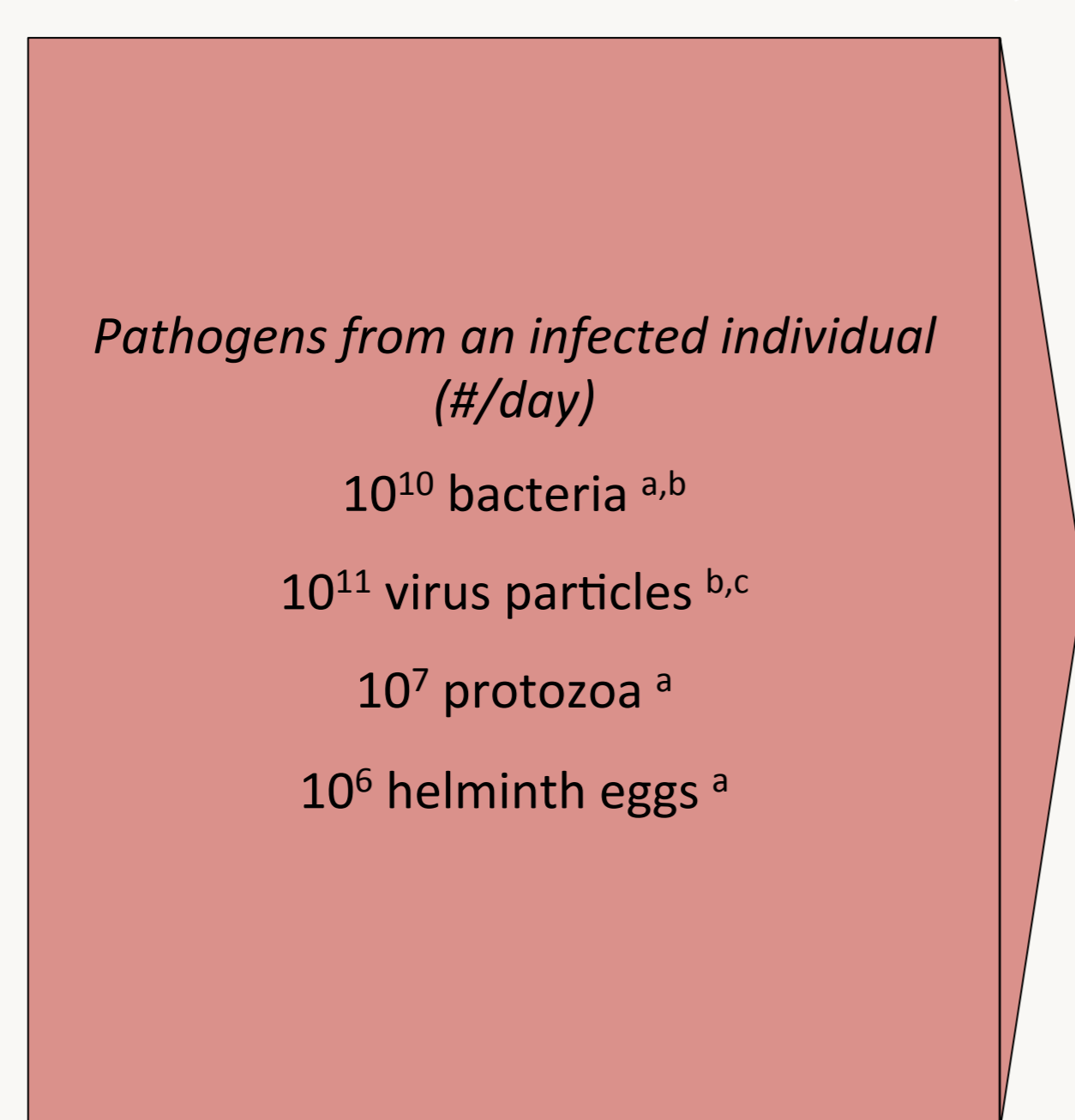
Use of the tool draws attention to:

- what a sewage treatment technology actually achieves in reducing pathogen numbers
- What pathogen levels might remain in planned and unplanned effluents leaving the treatment system
- Where those pathogens go in the environment.

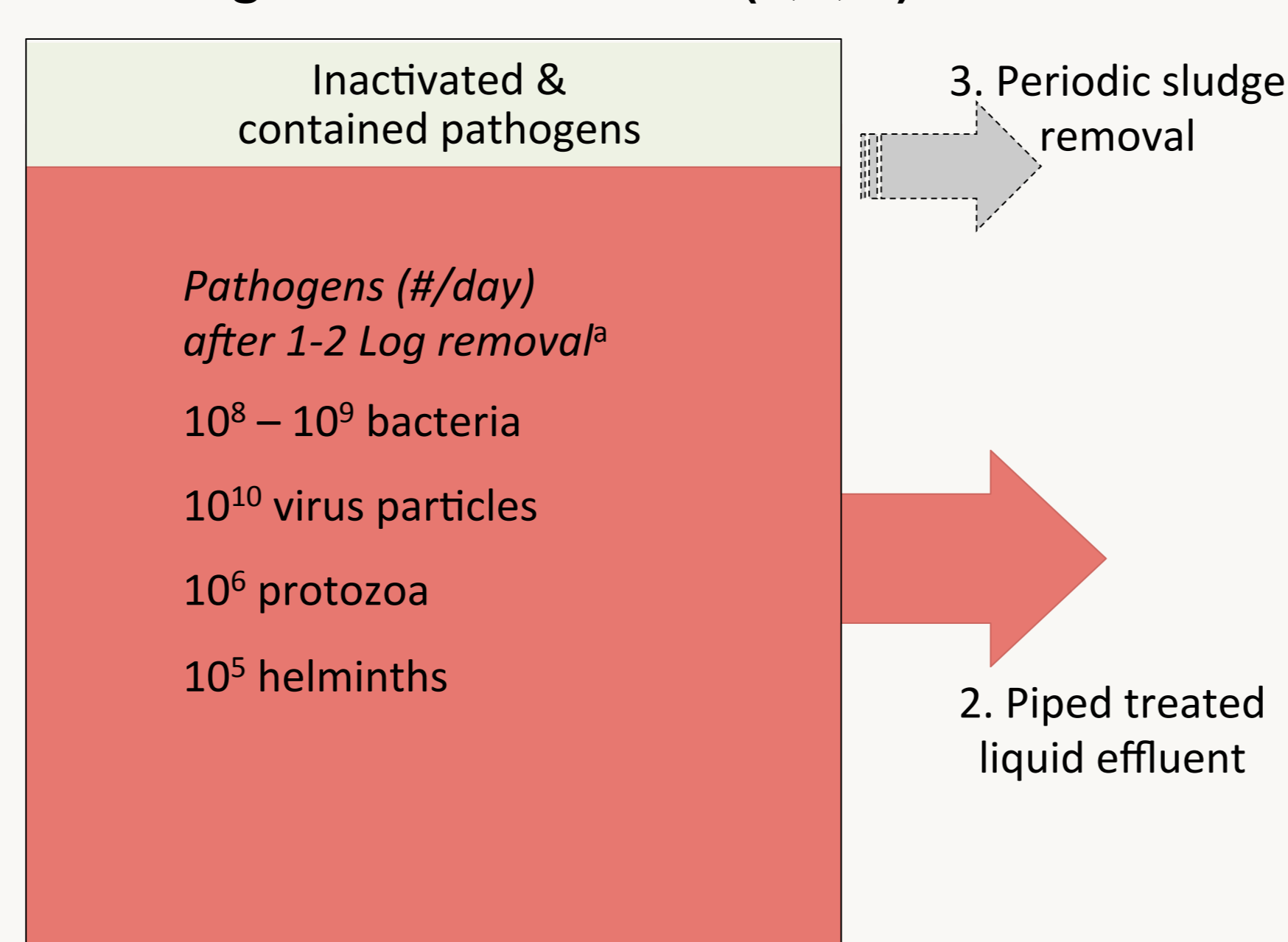


A. How many pathogens are in the influent?

Pathogen Hazard Diagram for a sealed tank with no secondary treatment (e.g. septic tank, anaerobic baffled reactor (ABR))



B. How many pathogens are leaving in treated wastes (1, 2, 3)?

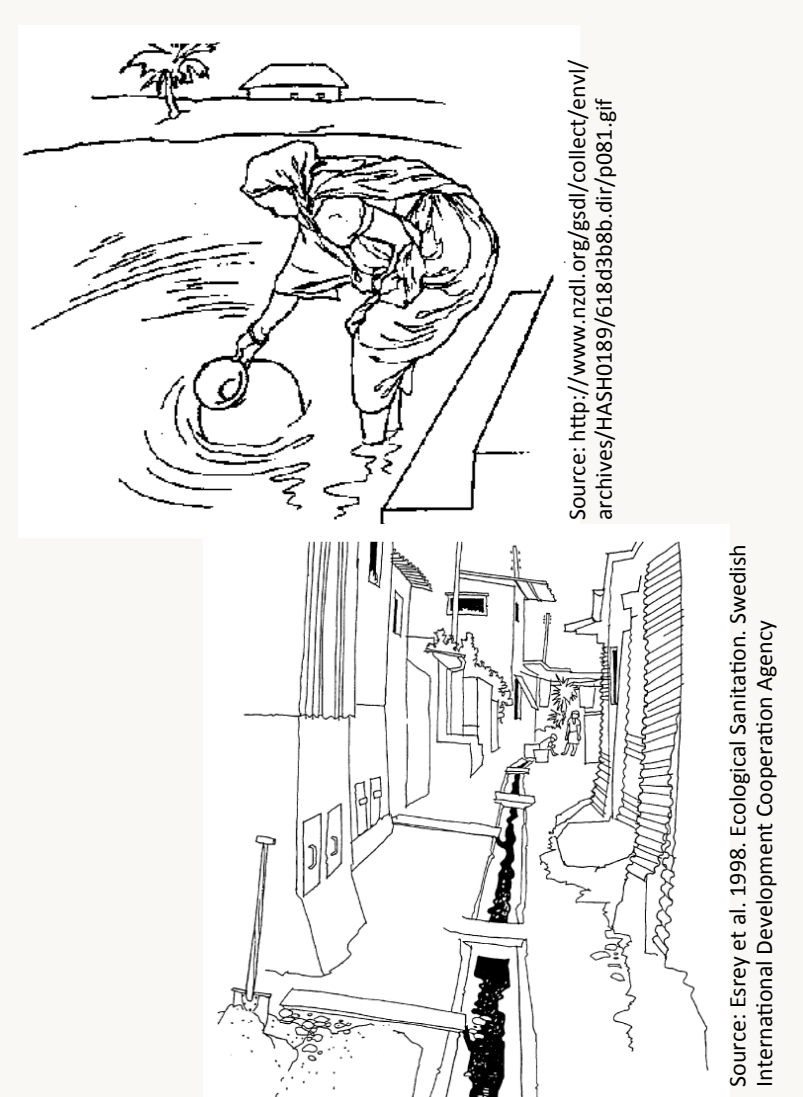


C. How much do the surviving pathogens matter?

What is the hazard level?

	Minimum infective dose	Potential hazard (# doses)
bacteria ^b	10 ² - 10 ⁸	Up to 10 ⁷
viruses ^b	10 ⁰ - 10 ¹	Up to 10 ¹⁰
protozoa ^b	10 ⁰ - 10 ²	Up to 10 ⁶
helminth eggs ^a	10 ⁰ - 10 ¹	Up to 10 ⁵

What are the potential exposure pathways?

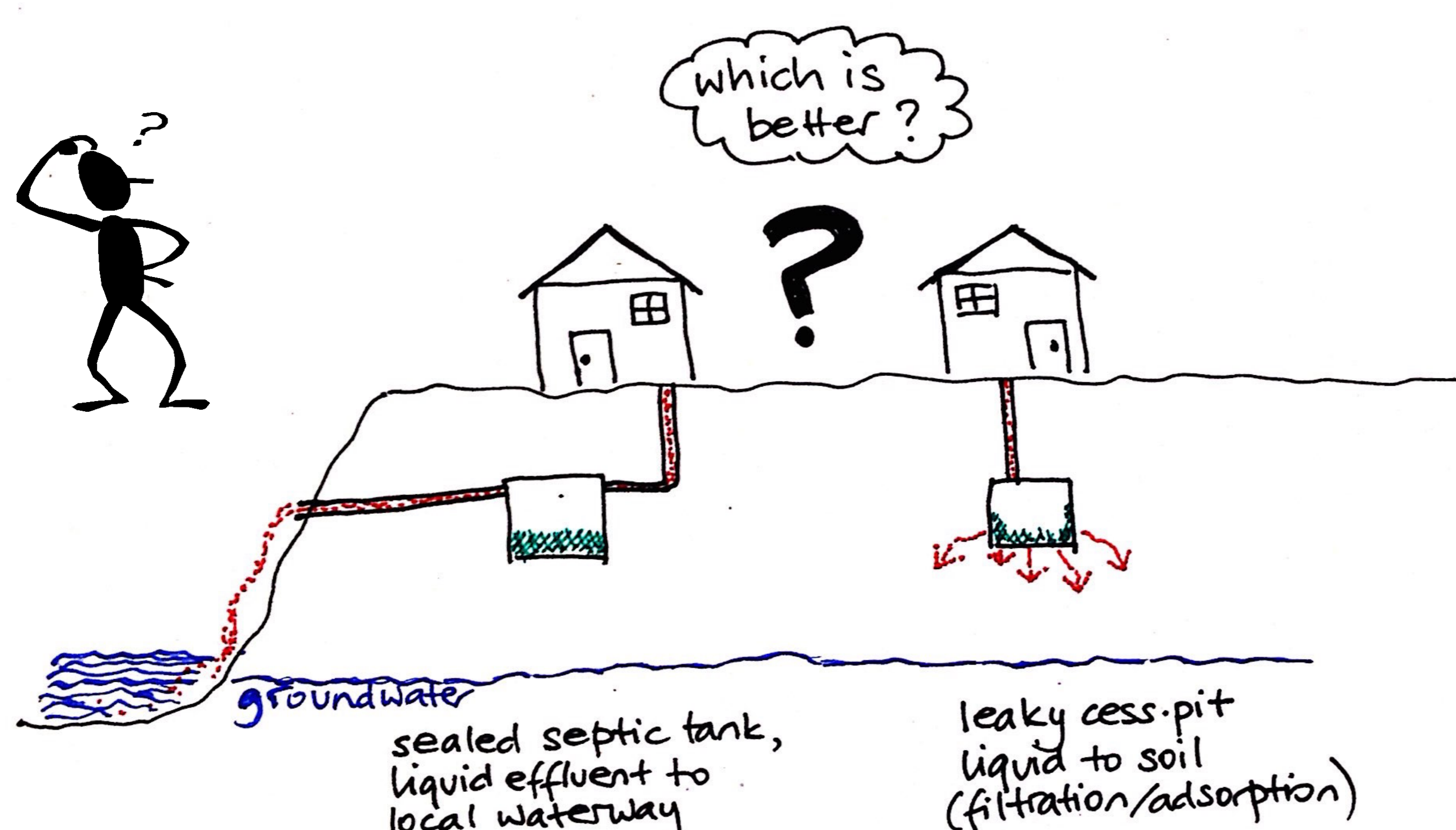


The treatment system boundary

1. Leakage and leachate

^a Feachem et al., 1983
^b Leclerc et al., 2002
^c McCray et al., 2009

What might this mean in practice?



Credits

This research was conducted under an Australian Development Research Award Scheme, investigating sanitation governance for community scale systems in Indonesia.

Other outputs from this project are available at: <http://communitysanitationgovernance.info>

For more details on the Pathogen Hazard Diagram, please see:

Mitchell, C., Abey Suriya, K. and Ross, K., 'Making pathogen hazards visible: a new heuristic to improve sanitation investment efficacy'. *Waterlines* vol 35 no 2, April 2016.

KEY REFERENCES

- Feachem, R.G., Bradley, D.J., Garelick, H., and Mara, D.D. (1983) *Sanitation and Disease: Health Aspects of Excreta and Wastewater Management*, New York: John Wiley & Sons <<http://go.worldbank.org/Z57F3M9XG1>> [accessed 29 February 2016].
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