WHO Guidelines for the Safe Use of Wastewater, Excreta and Greywater

A Management Tool

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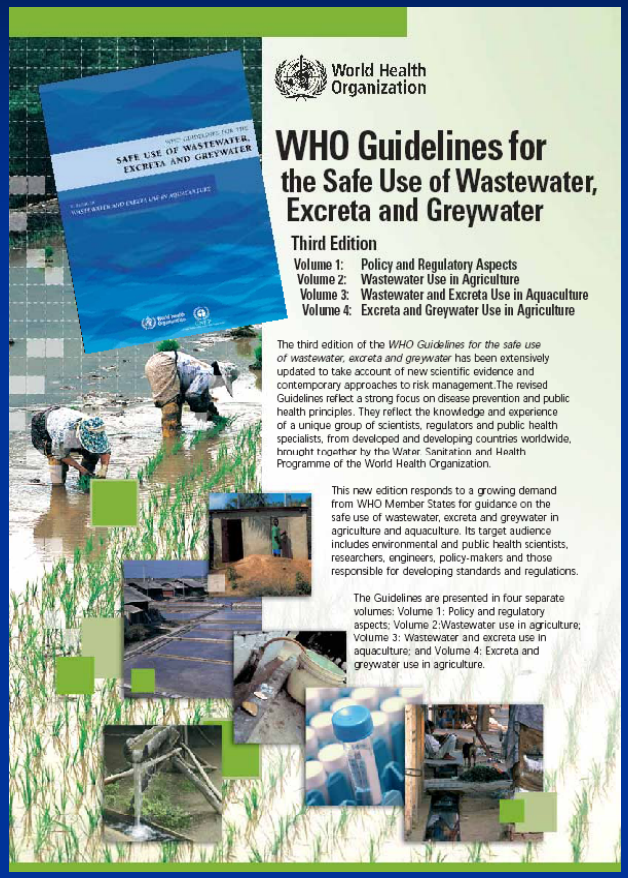
WHO Guidelines



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WHO Guidelines for the Safe Use of Wastewater, Excreta and Greywater

Third Edition

Volume 1: Policy and Regulatory Aspects
Volume 2: Wastewater Use in Agriculture
Volume 3: Wastewater and Excreta Use in Aquaculture
Volume 4: Excreta and Greywater Use in Agriculture

The third edition of the *WHO Guidelines for the safe use of wastewater, excreta and greywater* has been extensively updated to take account of new scientific evidence and contemporary approaches to risk management. The revised Guidelines reflect a strong focus on disease prevention and public health principles. They reflect the knowledge and experience of a unique group of scientists, regulators and public health specialists, from developed and developing countries worldwide, brought together by the Water, Sanitation and Health Programme of the World Health Organization.

This new edition responds to a growing demand from WHO Member States for guidance on the safe use of wastewater, excreta and greywater in agriculture and aquaculture. Its target audience includes environmental and public health scientists, researchers, engineers, policy-makers and those responsible for developing standards and regulations.

The Guidelines are presented in four separate volumes: Volume 1: Policy and regulatory aspects; Volume 2:Wastewater use in agriculture; Volume 3: Wastewater and excreta use in aquaculture; and Volume 4: Excreta and greywater use in agriculture.

Volume 1 of the Guidelines presents policy issues and regulatory measures distilled from the technical detail found in volumes 2, 3 and 4. Those faced with the need to expedite the development of policies, procedures and regulatory frameworks, at national and local government levels, will find the essential information in this volume. It also includes summaries of the other volumes in the series and an index for all four volumes.

Volume 2 of the Guidelines explains requirements to promote safe use concepts and practices, including health-based targets and minimum procedures. It also covers a substantive revision of approaches to ensuring the microbial safety of wastewater used in agriculture. It distinguishes three vulnerable groups: agricultural workers, members of communities where wastewater-fed agriculture is practiced and consumers. It introduces health impact assessment of new wastewater projects.

Volume 3 of the Guidelines informs readers on the assessment of microbial hazards and toxic chemicals and the management of the associated risks when using wastewater and excreta in aquaculture. It explains requirements to promote safe use practices, including minimum procedures and specific health-based targets. It puts trade-offs between potential risks and nutritional benefits in a wider development context. Special reference is made to food-borne trematodes.

Volume 4 of the Guidelines focuses exclusively on the safe use of excreta and greywater in agriculture. Recent trends in sanitation, including ecological sanitation, are driven by rapid urbanization. The momentum created by the Millennium Development Goals is resulting in dramatic changes in human waste handling and processing. New opportunities enable the use of human waste as a resource for pro-poor agricultural development, particularly in periurban areas. Best practice to minimize associated health risks is at the heart of this volume.

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WHO Guidelines

- The planning and implementation framework
- The assessment and evaluation of the health impact
- The mangement strategies

Guideline **objectives** and **structure**, Vol 4

- Protect the health of individuals;
- Benefit the health status of the communities
- Safe use of excreta and greywater in agricultural applications

➡ Recommend minimum safe practise requirements
➡ Support development and implementation of risk management
➡ Relate to quality targets and treatment barriers.
➡ Complementarity to other guideline volumes

Supporting Evidence:
Risk framework
Risk assessment

Impacting factors:
Environmental
Socio-cultural
Economic

Policy; Planning and Implementation

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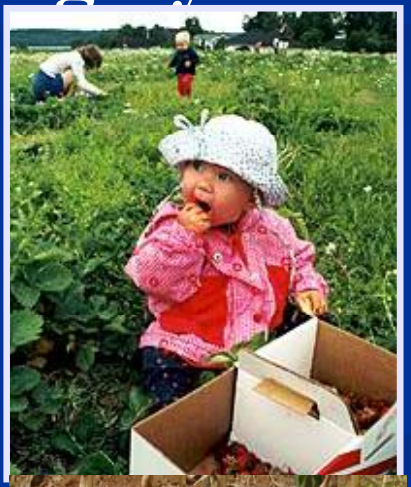
Institutional Arrangements

How to create institutional arrangements

- map out which sectors are of relevance
- make an inventory of successful existing institutional arrangements
- assess current and potential roles of sectors in safe use of wastewater, excreta and/or greywater
- organize a national event to start the national dialogue
- prepare an intersectoral action plan with a realistic budget

WHO Guidelines for the Safe Use of Wastewater, Excreta and Greywater.

Vol 4: Excreta and greywater use in agriculture



Key issue:

Exposure assessment in the handling chain

Handling strategy:

Risk management;
Health targets and
Acceptable risk

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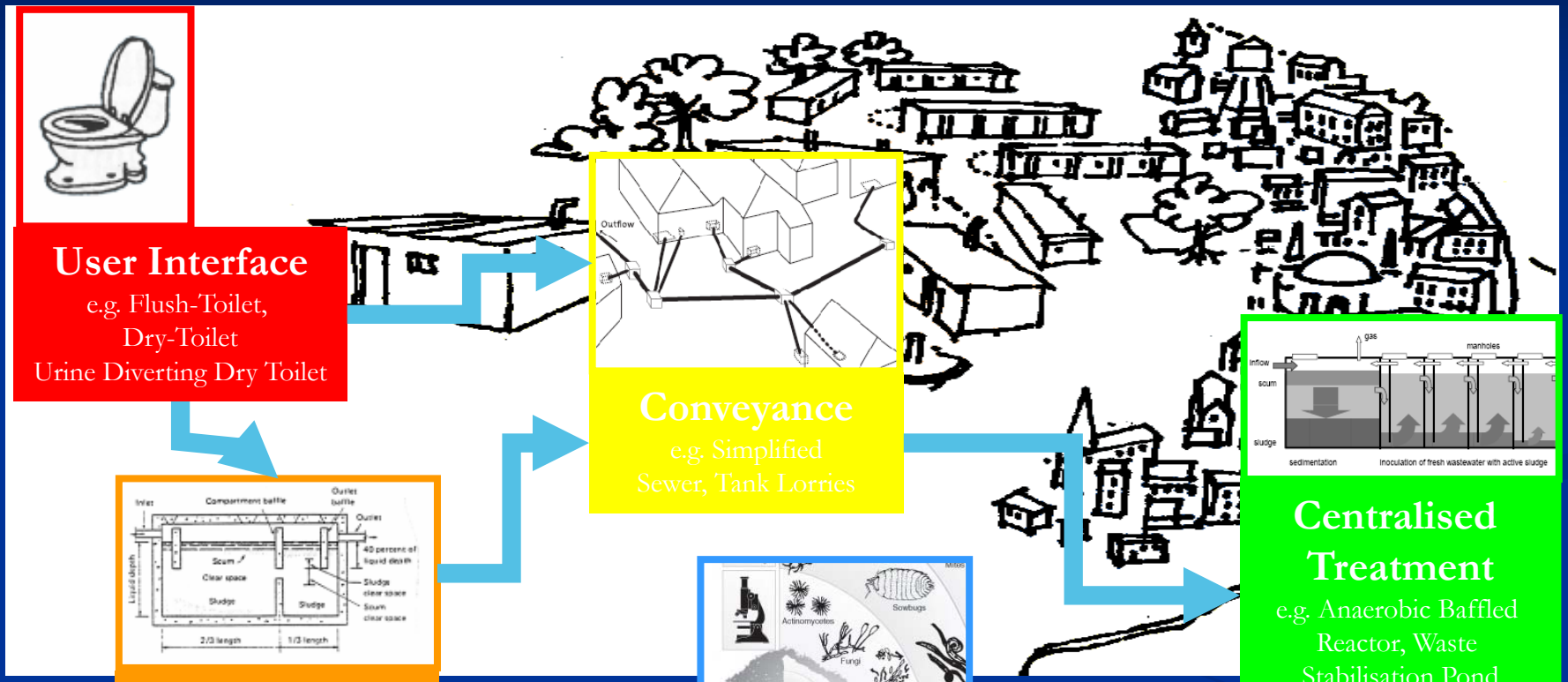
CONSIDER!

- Transmission pathways!
- Exposure! (Central)
- Quantity of organisms!
- Type of organisms!
- Reduction efficiency/Barriers/Die-off!

Functional Groups in a System



User Interface
e.g. Flush-Toilet,
Dry-Toilet
Urine Diverting Dry Toilet

Conveyance
e.g. Simplified
Sewer, Tank Lorries

Centralised Treatment
e.g. Anaerobic Baffled
Reactor, Waste
Stabilisation Pond

Collection and Storage
e.g. Septic Tank

Reuse and Disposal
e.g. Composting or Leaching Field

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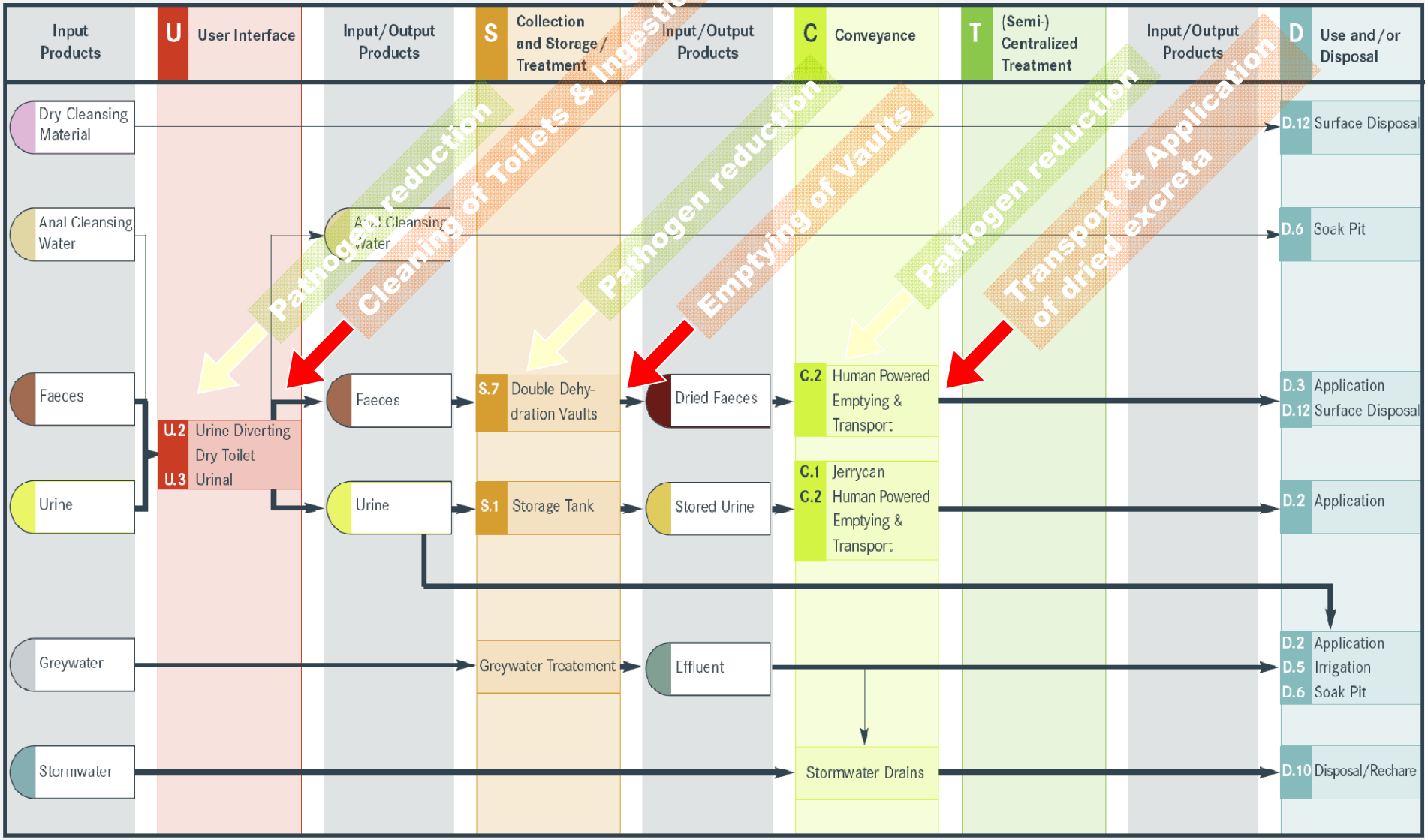
Example "system & exposure points"



22 Eawag-Sandec – Sanitation Systems
System Template 4 – Waterless System with Urine Diversion

Transmission routes

- Direct contact faeces – hand- mouth.
- Direct contact faeces – foot
- Faeces – animal – human
- Water polluted - Ingestion
- Faeces – flies – food
- Faeces – air – breathing and food

How many of these children puts something in their mouths?

Introduction of toilets will have limited impact if the environment Is contaminated . **Is it?**

Establish an evaluation system

- Which are the critical points of exposure?
- What are the barriers that may reduce the risks?
- What other operational or behaviours may affect the risk?

Designing a Sanitation System

- To design a robust system we must consider
  - What goes in
  - What comes out
  - What needs to be collected, stored, transported, processed, disposed of
  - What technologies can perform the required tasks
  - How we can link the required technologies

Documentation and Monitoring

- Establish a documentation system!
- Establish monitoring requirements!

Definition of Monitoring Functions

Function	Definition
Validation	Testing the system or components thereof to ensure if it is meeting e.g ”microbial reduction targets”. Mainly relates to new systems/components.
Operational monitoring	Relates to ”design specifications” e g turbidity. Indicate proper functions and variations and is the base for ”direct corrective actions”
Verification	Methods, procedures and tests to determine compliance with design parameters AND specific requirements (GL values, E coli, helminth eggs, microbial and chemical analysis of crops.

Pathogen reductions (log units) achieved by health-protection control measures

Control measure	Pathogen reduction (log units)	Notes
Excreta & urine treatment	2–6	The required pathogen removal depends on the combination of the treatment and selected health-protection control measures
Crop selection and means of application	2-4	Higher risk: Root crops and crops that grow just above (lettuce) and in partial contact with the soil. Lower risk: Crops with the harvested parts not in contact with the soil.
Pathogen die-off	2-4	Die-off on crop surfaces that occurs between application and consumption. The log unit reduction achieved depends on climate (temperature, sunlight intensity), crop type, etc. With-holding time essential in risk reduction
Produce washing with water	1	Washing salad crops, vegetables and fruit with clean water.
Produce peeling	2	Fruit, root crops.
Produce cooking	5–6	Immersion in boiling or close[d] water until the food is cooke[d] pathogen destruction.

Implementation approach

- Incidence of different disease in local context?
- Treatment efficiency and variability?
- Exposure; Who? How many? How often?

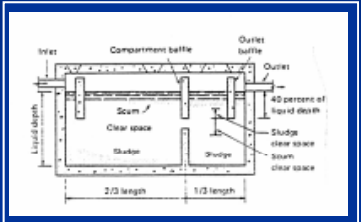
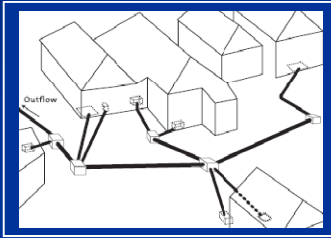
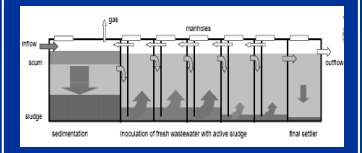
Implementation approach

- What crops are wastewater/sludge/excreta applied to?
- When in the crop cycle is it applied? What is the waiting period between last application and harvest?
- Who are exposed? Farmers – Consumers – Others?
- How often? How many? How frequently? Likely volumes of wastewater/sludge/excreta?
- How are the products handled after harvest and before consumption?

WHO Management

- The QUANTITY of certain microorganisms
- POINT of Exposure
- Where in the HANDLING Chain

Which technologies can perform in which functional group?

User Interface	Collection and Storage	Conveyance	(Semi-) Centralised Treatment	Reuse and Disposal
				
• Dry Toilet • Urine Diverting Dry Toilet • Urinal • Pour-Flush Toilet • Flush Toilet	• Single Pit • Single Pit VIP • Alternating Dry Double Pit • Alternating Wet Double Pit • Double Dehydr. Vaults • Aquaprivy • Septic Tank • Composting Chamber	• Manual Emptying • Mechanical Emptying • Simplified Sewers • Small-Bore Sewer • Conventional Gravity Sewer • Jerry Can/Tank	• Imhoff Tank • Anaerobic Baffled Reactor • Anaerobic Filter • Trickling Filter • Waste Stabilisation Ponds • Finishing Pond • Constructed Wetland • Co-composting etc.	• Application of Urine • Application of Dehydr. Faeces • Compost • Irrigation with Wastewater • Aquaculture • Soak Pit • Leaching Field • Incineration • Land Application • Surface Disposal

Only selected combinations of technologies will lead to functional systems.

2006 WHO Guidelines on Wastewater, Excreta and Grey Water Use?

Guidelines provide an *integrated preventive management framework* for maximizing public health and environmental benefits of waste use.

Health components:

•Defines a level of health protection that is expressed as a health-based target;

•Identifies health protection measures **which used collectively** can achieve the specified health-based target.

Implementation components:

•Establishes monitoring and system assessment procedures;

•Defines institutional and oversight responsibilities;

Requires:

•System documentation; and

•Confirmation by independent surveillance.

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Microbial GL values

- Mainly applicable for verification monitoring in larger systems
- Design criteria (system validation) - the main factor in addition to exposure control to counteract risks and variabilities.
- Storage and treatment additives as aid in the barrier efficiency.

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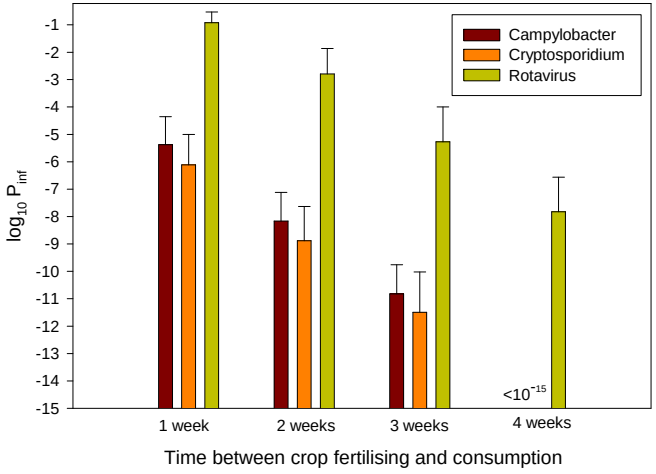
	Helm. Eggs	E. coli
Treated fecals	< 1/ g TS	Helminths. Low incidence *E coli* < 1000/g TS
Greywater: • Restricted	< 1/L	< 10^5 Relaxed 10^6 <exposure >regrowth
• Unrestricted	< 1/L	< 10^3



Finding the Guidelines

http://www.who.int/water_sanitation_health/

CD-ROM 'electronic library' (from 5th edition)

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