WHO Guidelines
Safe Use of Wastewater
Greywater and Excreta

World Health Organization
Wastewater Use at a Glance
Most wastewater is untreated

- Up to 90% of all wastewater in developing countries is discharged untreated directly into rivers, lakes or the oceans.

- Wastewater use is extensive worldwide and increasing:
  - 20 million hectares in 50 countries are irrigated with raw or partially treated wastewater;
  - 10% of the world’s population is thought to consume wastewater irrigated foods.

- The extent is difficult to quantify due to the informal nature of the practice.
Demand to use it will grow

Bluewater scarcity by 2025

Further water resources development in is increasingly limited by rising difficulties to mobilise more water (RED) or economic difficulties (Yellow)  

IMWI, 2000
Safe use can support national and international policy objectives

- MDG Goal 1: Eradicate extreme poverty and hunger
- MDG Goal 7: Ensure environmental sustainability
- Post 2015 Sustainable development goal – wastewater target

International Policy framework:

- poverty reduction
- food security
- protection of public health
- protection of the environment
- consumer protection
- integrated water resources management
- energy reliance

National Policy aspects:
Health Risks and Benefits
Health concerns

Direct Health Effects

- **Disease outbreaks** (food, water and vector borne)
- **Persistent diseases** (e.g. intestinal helminth infections, diarrhoeal diseases)
- **Non-communicable diseases** (waste water mixed with industrial waste containing heavy metals)

Indirect Health Effects

- Adverse impacts on the safety of drinking water, food and recreational water.
- Positive impacts on household food security and nutrition

3 GROUPS TO CONSIDER:

- workers
- community
- consumers
Assessment of Health Risk

A health risk exists if:
- an infective dose of a pathogen reaches a crop
- or a pathogen that reaches a crop multiplies to an infective dose, and
- the infective dose reaches a human host (directly or indirectly through a vector)

What is a tolerable health risk?
- Based on local public health conditions
- Health priorities (hazards, types of diseases and relative importance)
- Capabilities (institutional, economic, social)
- Can be expressed in DALY's
2006 WHO Guidelines
For the Safe Use of Wastewater, Excreta and Greywater
Objective: To Maximize the protection of human health and the beneficial use of human waste.

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

Target Audience:
Policy makers, regulators, public health scientists, educators, researchers and engineers
Scope

- **Intentional use.** But they may also be relevant to some unintentional uses (e.g. irrigation or aquaculture with sewage contaminated surface waters)

- Municipal or domestic wastes *without substantial industrial inputs*

- *Faecal sludge derived from on-site sanitation* facilities but not sludge produced from the treatment of wastewater

- Detailed information only on matters related to *health protection*. Some aspects of environmental protection.
Some lessons from the 1989 guidelines

- **Overly strict standards** borrowed from other countries often fail
- **Guidelines are not just numbers**; they are made up of good practice + microbial water quality standards
- **Low-cost effective treatment technologies** needed
- **Risk reduction is necessary** (and possible) where wastes receive *no or inadequate treatment*
2006 WHO Guidelines

Irrigation water quality thresholds

Wastewater generation

Farmer/Producer

Traders/Retailers

Kitchen staff

Health-based targets (DALYs)

Consumer

Awareness creation to create demand for safe produce

Facilitating behaviour change via education, financial & non-financial incentives, and regular inspections

Safe Irrigation Practices

Hygienic Handling Practices

Safe food washing and preparation

1989 WHO Guidelines

2006 WHO Guidelines

Health-based targets (DALYs)
DALY
Disability Adjusted Life Year is a measure of overall disease burden, expressed as the cumulative number of years lost due to ill-health, disability or early death

\[ \text{YLD} \quad \text{Years Lived with Disability} \]
\[ + \quad \text{YLL} \quad \text{Years of Life Lost} \]

Healthy life

Disease or Disability

Early death

Expected life years
Health protection measures

Health based target can be reached through a combination of management options such as:

- Wastewater treatment
- Crop restriction
- The method of irrigation
- Food preparation
  - Washing
  - Disinfection
  - Peeling
  - Cooking
- Hygiene practices at the marketplace
- Vaccines and other health sector preventive measures
Implementation of the guideline
Various WHO Guidelines on Water Quality

Guidelines for Drinking-water Quality

Fourth Edition

Water Safety Plan Manual for drinking-water suppliers

Sanitation Safety Plan Manual
Preventive management / multi-barrier approach through Water and Sanitation Safety Plans

Example barriers:

- Wastewater treatment
- Crop restriction
- The method of irrigation
- Washing
- Peeling
- Cooking
- Market hygiene
- Vaccines

Multiple barriers to prevent contaminants coming in (single exposure group)
### Control measure effectiveness

<table>
<thead>
<tr>
<th>Control measure</th>
<th>Pathogen reduction (log units)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>C. Post-harvest options at local markets</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overnight storage in baskets</td>
<td>0.5–1</td>
<td>Selling produce after overnight storage in baskets (rather than overnight storage in sacks or selling fresh produce without overnight storage)</td>
</tr>
<tr>
<td>Produce preparation prior to sale</td>
<td>1–2</td>
<td>(a) Washing salad crops, vegetables and fruit with clean water</td>
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<tr>
<td></td>
<td>2–3</td>
<td>(b) Washing salad crops, vegetables and fruit with running tap water</td>
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<tr>
<td></td>
<td>1–3</td>
<td>(c) Removing the outer leaves on cabbages, lettuces, etc.</td>
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<tr>
<td><strong>D. In-kitchen produce-preparation options</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Produce disinfection/washing</td>
<td>2–3</td>
<td>Washing salad crops, vegetables and fruit with an appropriate disinfectant solution and rinsing with clean water.</td>
</tr>
<tr>
<td>Produce peeling</td>
<td>2</td>
<td>Fruits, root crops</td>
</tr>
<tr>
<td>Produce cooking</td>
<td>5–6</td>
<td>Option depends on local diet and preference for cooked food.</td>
</tr>
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<td>Notes</td>
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<tr>
<td><strong>A. Wastewater treatment</strong></td>
<td>up to 6–7</td>
<td>Pathogen reduction depends on type and degree of treatment selected</td>
</tr>
<tr>
<td><strong>B. On-farm options</strong></td>
<td></td>
<td></td>
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<tr>
<td>Crop restriction (i.e., no food</td>
<td>6–7</td>
<td>Depends on (a) effectiveness of local enforcement of crop restriction, and (b) comparative profit margin of the alternative crop(s)</td>
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<tr>
<td>crops eaten uncooked)</td>
<td></td>
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<tr>
<td><strong>On-farm treatment:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) Three-tank system</td>
<td>1–2</td>
<td>Very effective for helminth egg sedimentation.</td>
</tr>
<tr>
<td>(b) Simple sedimentation</td>
<td>0.5–1</td>
<td>If ca. 18 hours; more effective for helminth eggs</td>
</tr>
<tr>
<td>(c) Simple filtration</td>
<td>1–3</td>
<td>Value depends on filtration system used</td>
</tr>
<tr>
<td><strong>Safer wastewater application:</strong></td>
<td></td>
<td></td>
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<tr>
<td>(a) Furrow irrigation</td>
<td>1–2</td>
<td>Crop density and yield may be reduced</td>
</tr>
<tr>
<td>(b) Low-cost drip irrigation</td>
<td>2–4</td>
<td>2-log unit reduction for low-growing crops, and 4-log unit reduction for high-growing crops</td>
</tr>
<tr>
<td>(c) Reduction of splashing</td>
<td>1–2</td>
<td>Farmers trained to reduce splashing when watering cans used (splashing adds contaminated soil particles on to crop surfaces which can be minimized)</td>
</tr>
<tr>
<td><strong>Pathogen die-off (cessation)</strong></td>
<td>0.5–2</td>
<td>Die-off between last irrigation and harvest (value depends on climate, crop type, etc.)</td>
</tr>
</tbody>
</table>

**Notes:**
- Pathogen reduction depends on type and degree of treatment selected.
- On-farm options depend on (a) effectiveness of local enforcement of crop restriction, and (b) comparative profit margin of the alternative crop(s).
- Safer wastewater application: Crop density and yield may be reduced.
- Pathogen die-off: Die-off between last irrigation and harvest (value depends on climate, crop type, etc.).
Risk Management (SSP) Tasks

Task 1 – Define the system boundaries and assemble the SSP team

Task 2 - Describe sanitation system within the boundary

Task 3 - Identify hazards, assess existing controls, and assess exposure risk

Task 4 - Develop and implement an incremental improvement plan

Task 5 - Monitor the plan and check that controls are working

Task 6 – Develop supporting programmes and regularly review SSP

Continuous improvement
Volume 1: Institutional aspects
How to start?

Creating a platform:
- Situation analysis and needs assessment
- Obtain political endorsement
- Establish a mechanism for policy dialogue
- Engage in an adequately resourced policy dialogue
- Ensure policy changes are legitimized through Parliament and/or decreed by the Prime Minister’s Office

Institutional Arrangements:
- Agreed mechanisms for coordination and resource sharing between sectors
- Identification of roles and responsibilities
- Incentive: partial inputs lead to credit for 100% outcome
- through specific MoU between sectors
- through existing intersectoral mechanisms
- by operating at lower levels of governance
All publications can be found at:

www.who.int