Ending the madness.......  
South African (& Other African) Experiences

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African Cities – The Urbanisation Challenge

- Increasing urbanisation – highest in the world over last 2 decades
- High proportion of slum dwellers in SSA (65%)
- Insufficient basic infrastructure
2008

Image from Mr. Neil MacLeod (former Ethekwini Water & Sanitation)
2013

Image from Mr. Neil MacLeod (former Ethekwini Water & Sanitation)
Binary Implementation Model

Conventional WWTW

- FLUSH-&-FORGET
- Considered “gold standard”
- Resource intensive (Capital, Sewers, Water, Energy, etc.)
- Challenge to meet urbanisation & population growth
- Expensive & beyond reach of developing countries
- Established technologies (discharge regulations, guidelines, policies, etc.)

On-Site Sanitation

- DROP-&-STORE
- Most prevalent tech in SSA
- Little / no water
- 5-50% cheaper (than activated sludge)
- Can be scaled at urbanisation rates
- Faecal Sludge Management – lack of policies & standards, disposal routes, O&M overlooked.
- Viewed as “temporary” solution

Technological Gap
57% connected to reticulated sewerage

Photo:

Technology Gap or Trap?

Around 40% of South Africans do not have flush toilet (incl. septic tank)
10% with VIP
20% with pit latrine
The strong political drive to provide universal access

9 million more people connected to the waterborne network

Push for technically advanced technologies as the preferred solution to small towns

WRC study showed that 44% of the 18 WWTW surveyed:
- Less suitable & expensive choice
- Insufficient funding for effective operation and maintenance of the technology.

There could >300 WWTW where inappropriate choice has been implemented
The **Dry** South African Context

- Large infrastructure programmes to build VIP latrines outside sewered boundary
- Around 30% of South Africans rely on VIP and derivatives
- Tipping point being reached – pits were filling BUT many municipalities did not O&M budget, policies & procedures for management
- 60% facilities conducting reactive maintenance while 40% had inadequate maintenance capacity.
- Limited technical know to empty & disposal pit contents
Dry Sanitation

1 pit = 1 m³

3 million pits = problem

Landfill is only available option but we reaching limits
Disposal can be a problem!

Access can be a problem!
Research Strategy

- **Improvements (current)**
  - Water reuse/reclamation
  - Sludge beneficiation
  - Energy recovery
  - Efficiency
  - Technology shifts

- **Incremental**
  - Embedding new concepts
  - Resource recovery
  - New infrastructure and design
  - Adapted technology

- **Disruptive**
  - Paradigm shift
  - Off grid (next generation)
  - Biorefineries
  - Biomimicry

**NOW**

**MEDIUM TERM**

**LONG TERM**
New Thinking for Existing Flush Toilets

Explored the concepts of:
1. Sustainability
2. Low-cost treatment
3. Limited skill set
4. Low O&M
5. Integration
6. Beneficiation
7. Social upliftment

Small Wastewater Options
(<100 m³/d)
Integrated Algal Ponds Systems

- IAPS commissioned in Belmont WWTW 75m³/d
- In-pond digester, an advanced facultative pond, two high-rate oxidation ponds and two algal settling ponds connected in series
- Energy requirement low
- Algae generated envisaged as fertiliser substitute
Performance

• Verge of meeting the stricter compliance standards for water discharge
• System not operated at its optimum and with no tertiary polishing step
• Average Effluent Conc.:
  – COD = 94 mg/l
  – NH$_4^-$-N = 2 mg/l
  – PO$_4^{3-}$-P = 4 mg/l
  – TSS = 31 mg/l
• With maturation ponds and slow sand filtration, water discharge standards could be achieved.
Microalgae Biomass as Organic Fertiliser
Industrial Water: Reuse of Brewery Effluent: algal ponds, wetlands, hydroponics and aquaculture

Source Separation: don’t send to sewer

Technology Integration Approach

High Rate Algal Ponds

Aquaculture (ornamental fish)

Hydroponics

Opportunity: Urban Agriculture
DEWATS Process

- Pioneered by BORDA in developing world
- Suitable in SA for high-density communities not connected to sewered network
  - RDP houses
  - Communal Ablution Facilities
- Design Considerations
  - No pre-existing sewerage network
  - Semi-pressurised roof tanks
  - Water available for flushing
  - No sensitive catchments near discharge point
  - Dense housing arrangements not suitable for septic tanks
    - Septic tanks designed for toilet water not for laundry, washing, etc.
    - Space limited for evapotranspiration areas
Conventional centralized systems

DEWATS Approach

Common on-site systems
WRC funded R&D from Pilot to Technical Demonstration
Waste to Agriculture

- Integrating agriculture into design of on-site sanitation
- Effect of wastewater / sludge on soil chemical properties
- Different soils + crops + treatments
- Crop modelling
On-Site Systems Part of Sanitation System
How to Beneficiate Sludge

- Incremental research into development & improvement of various faecal sludge treatment options
- Beneficiation of faecal sludges encouraged
- Technologies include:
  - Optimising the LaDePa process
  - Entrenchment of sludges
  - Anaerobic digestion
Latrine Dehydration Pasteurisation
LaDePa Process

Ladepa: Principle of Operation
Entrenchment of Sludges
Sludge burial research site - Umlazi
Umlazi Trial
– sludge burial Jan 2009
Fate of pathogens after burial
DeFAST – Decentralised Sludge Treatment
Sludge Made into Fuel Products
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