The Sanitation Research Fund for Africa Project

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WRC Strategy

Contribute to economic development on various scales

Sustainable technology with focus on O&M, beneficiation/reclamation/re-use

Increase competency and capacity

Inform policy and decision-making

Challenge of Pit Latrines

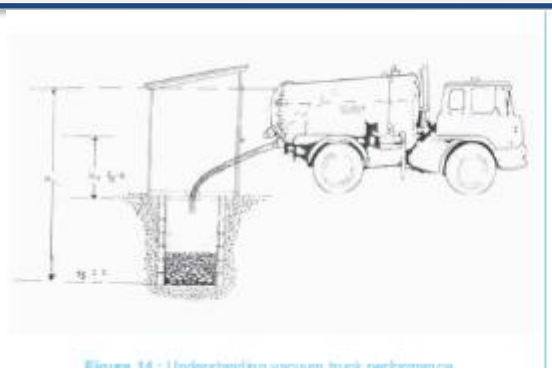
- Push towards service delivery (national policies, MDGs) resulted in proliferation of pit latrines technologies
- South Africa – nearly 3 million VIP toilets installed since 1994
- Little attention given after installation
  - Pits eventually fill
  - Risks associated with emptying and disposal

  How to safely remove & dispose of sludge?
- Policy vacuum regarding faecal sludge management
- Not much evidence based research

A full pit as seen from toilet

PROBLEM NOT CONFINED ONLY TO SOUTH AFRICA

Challenges: Emptying & Disposal



A typical situation

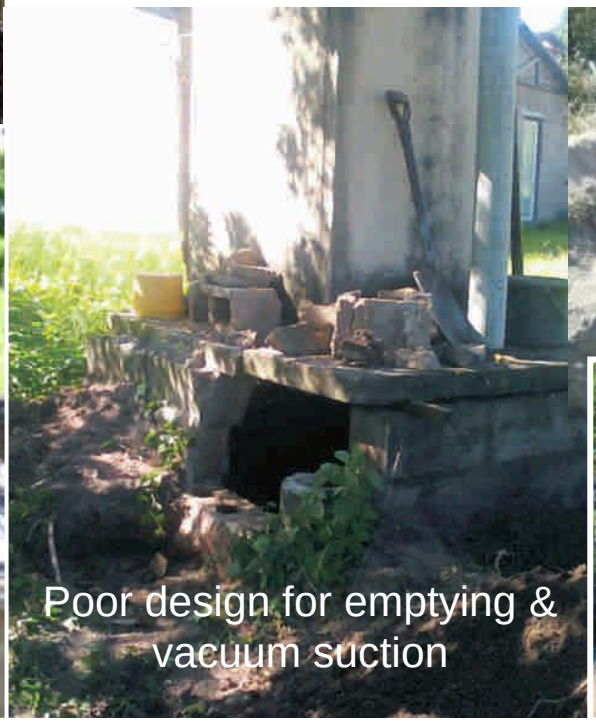
A vacuum truck's pump performance is sown to 0.5 bar (5.0m water)
Due to water

Waste density at bottom pit is 1.5sg

Waste height in truck 2.5m

Theoretical static head is 5.0 1.5=3.2m

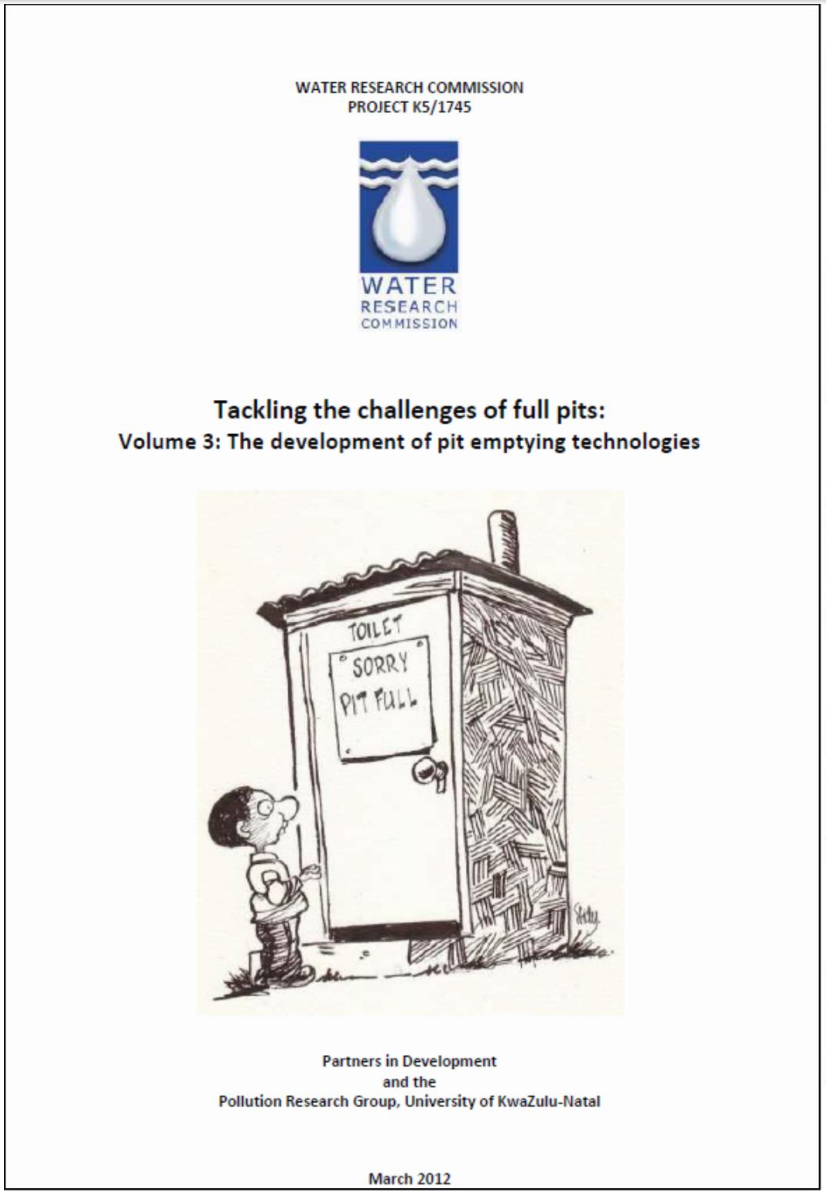
Truck can only suck from 3.2-2.5=0.8m below Ground level



WRC Research to date

Research Report K5/1745 "Tackling the Challenges of Full Pit Latrines"

- Pits filling faster than design rate
- Research was required to better understand the characteristics of faecal sludge, pit filling rates, pathogen survival rates, etc.
- the efficacy of additives
- lightweight VIP super structures
- franchising O&M services
- Pour flush and new pedestal designs
- Low flush
- Beneficiation – deep row entrenchment, struvite production
- PeTs



WATER RESEARCH COMMISSION
PROJECT K5/1745

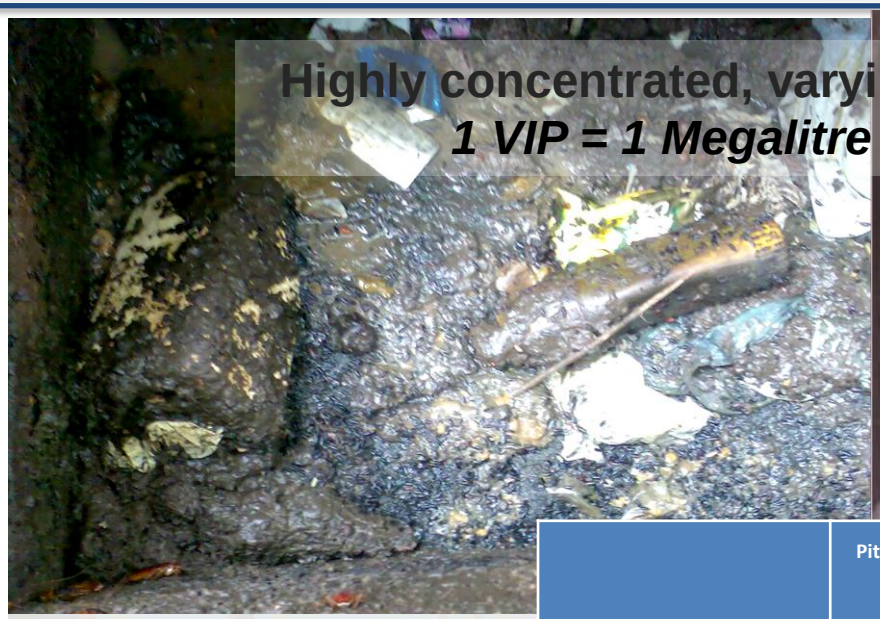
WATER RESEARCH COMMISSION

Tackling the challenges of full pits:
Volume 3: The development of pit emptying technologies

Partners in Development
and the
Pollution Research Group, University of KwaZulu-Natal

March 2012

Outputs to Date: Pit Contents



Highly concentrated, varying wetness & trash content

1 VIP = 1 Megalitre of normal sewerage

Infectious agents

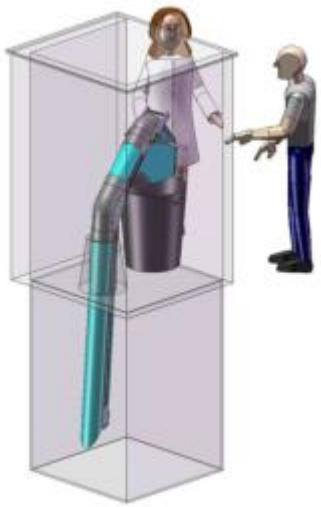
	Pit latrine sludge	High strength sludge from bucket latrines and public toilets	Low strength sludge from septic tanks	Sewage – in waterborne sewerage systems
Source	Brouckaert and Foxon, 2008	Heinss et al, 1998		
COD (mg/l wet)	90 000-225 000	20 000-50 000	< 10 000	500 – 2 000
COD (mg/g dry)	210-1230	571-1429	<333	50-200
N as NH_4 (mg/l wet)	9 000 (TKN)	2 000-5 000	<1 000	30-70
N as NH_4 (mg/g dry)	100 (TKN)	60-150	<33	3-7
Total solids (%)	20	>3.5	< 3	< 1
Soluble solids(mg/l wet)	220 000	≥30 000	≈ 7 000	200-700

Source: Foxon KM and Still DA (2012) ***TACKLING THE CHALLENGES OF FULL PIT LATRINES***
Volume 1: Understanding sludge accumulation in VIPs and strategies for emptying full pits

Pictures: WINSA Seminar Report, 14-15 March 2011

PeTs – Pit emptying technologies

Hand Tools



The Gobbler

Bangalore Screwer

Pit Screw Auger

Vacutug

Need to Build Research Capacity in Africa

- FSM policy lacking in African countries
- Local capacity in Africa lacking
  "Africans to develop solutions for Africans"
- Stimulus required for R&D in FSM
  - Solutions based on evidence-based research
  - New, innovative solutions based on local needs

Photo: "Upscaling Basic Sanitation for the Urban Poor", Sustainable Sanitation (Flicker, 2011)

Need for More Research

- **Sludge characteristics**:
  - To encompass the effects of different behaviours, diets, etc. on sludge characteristics
  - To understand the processes occurring pit latrines
  - To design appropriate desludging tools
- **New tools are required**:
  - Lightweight designs
  - Easily transportable
  - Handle varying sludge characteristics
  - Cost-effective (fabrication, maintained, repaired)
  - Simplistic and easy to use
- **Beneficiation routes need to be explored**:
  - Simple
  - Cost-effective
  - Value-added by-products – energy, fertiliser etc.

Example: Deep Row Entrenchment

Example: Ethekwini LaDePa

The SRFA Project

Bridging and building a network of sanitation solution providers and capacity across Africa

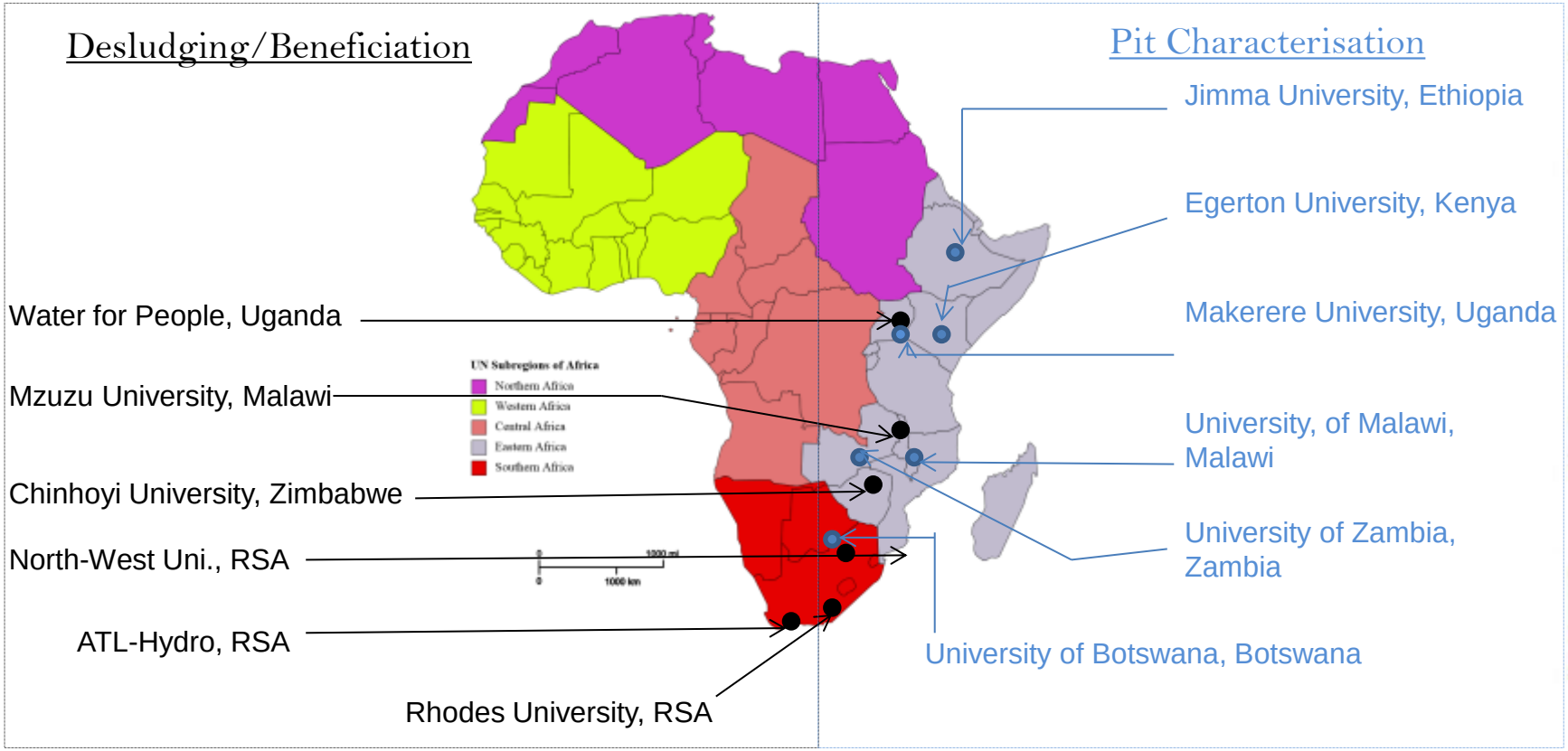




- Established through Bill & Melinda Gates Foundation grant to the WRC
- Project to run over 2.5 years (2013 to 2015)
- BMGF contributing US$ 2.5M toward project costs
- WRC contributing around US$ 500,000
- Twelve projects initially selected - awarded grants up to US$ 200,000 each
- Two key focus areas:
  - ❖ Pit Characterisation
  - ❖ Developing Innovative Tools for Desludging and Beneficiation
- Standardisation of analytical techniques to compare among groups
- Capacity Building: Post-graduate students (PhDs, MSc) is compulsory

Research Nodes

- Twelve research organisations / institutions selected in Southern and Eastern Africa based on peer review of proposals
  - 6 groups to characterise faecal sludge in different locations
  - 6 groups to develop innovative desludging tools and/or subsequent beneficiation routes.



Expected Outputs

- Strengthening of FSM capacity in Africa
  - Institutional/Organisational capability to perform scientific services
  - 12 PhD students
  - 18 MSc students
  - Undergraduate, In-Service Trainees, Technicians, etc.
- New ideas and innovation
  - Better understanding of pit processes under varying conditions
  - Sustainable technological options
- Comprehensive knowledge database
  - Can be used by service providers, designers, etc.
  - Develop national policy on FSM





Characterise Faecal Sludge

- Different areas, layers, pit age
- Moisture & Solids Content
- COD
- Nutrients
- Pathogens
- Mechanical Properties

Develop Innovative Tools for FSM

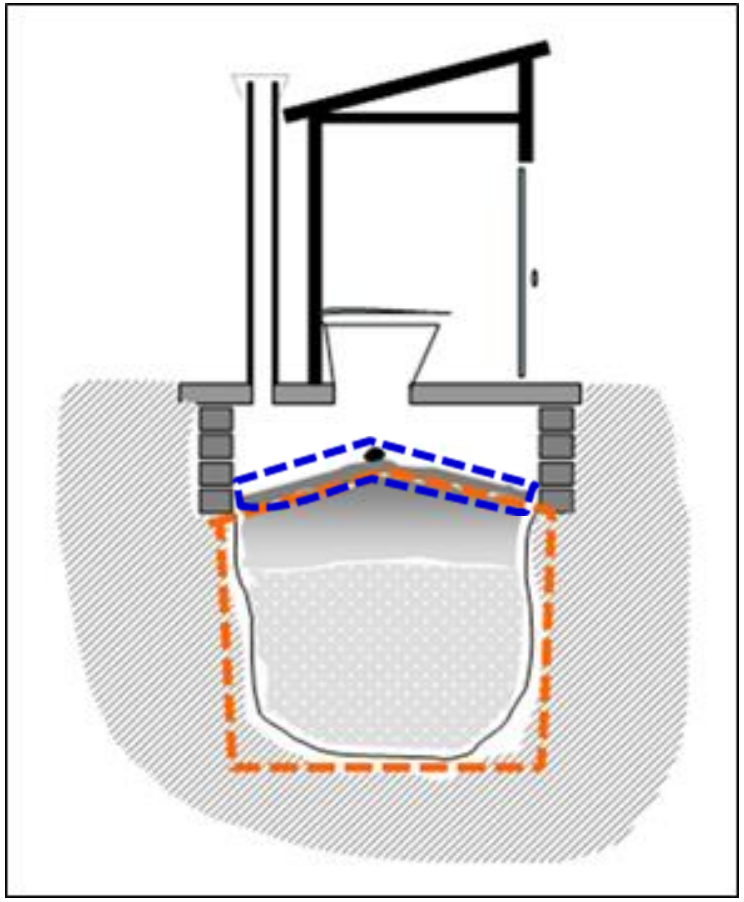
- New Desludging Tools
- Biochar
- Dewatering Plants
- Anaerobic Digestion
- Degradation via Biological Agents

Capacity Building

- Develop local skills in FSM
- Develop national policy on FSM

Pit Characterisation

- Processes/Degradation
  - Different climatic conditions, diets
  - Different layers
  - Pit age
  - Pit filling rates
- Mechanical properties
  - Shear determined
  - Different layers
- Health & Safety
  - Pathogen indicator survival
  - Groundwater pollution
  - During emptying & disposal
  - Beneficiation routes



Source: Foxon KM and Still DA (2012) *TACKLING THE CHALLENGES OF FULL PIT LATRINES Volume 1: Understanding sludge accumulation in VIPs and strategies for emptying full pits*

Improved Toilet Designs

Modular concrete toilets

Photo: Steve Sugden

Pour flush toilets

Photo: Steve Sugden

Cartridge Toilets

Photo: Atl-Hydro

Desludging Tools

Mechanical & hand operated devices
Sharing of equipment between groups to evaluate performance under varying conditions
Pro vs Cons evaluated

Photo: Rochelle Holm

Photo: Steve Sugden

The Nibbler

Photo: Steve Sugden

The Rammer

Photo: Steve Sugden

The New Gulper

Beneficiation Technology

- Mobile solar pyrolysis unit that converts sludge into biochar
  - Compost
  - Fuel source
- Dewatering and composting plant
- Biological agents
  - Tiger worms
  - Black Soldier Fly larvae
- Anaerobic digestion technologies
  - Pilot system in peri-urban areas
  - Co-digestion with municipal waste
  - Combined with pasteurisation

  → Compost products

Pyrolysis Unit

Gas Stove

Photos: Atl-Hydro

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