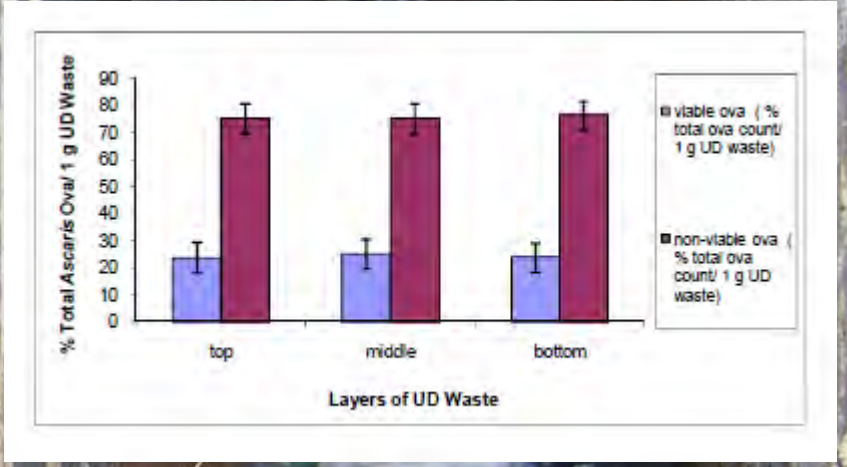
From Waste Management to Resource Recovery: Lessons from South Africa

Sudhir Pillay
Research Manager: Special Projects
Water Research Commission
Pretoria, South Africa

Where We Come From:

- Pre 1994: Legacy of apartheid
- Post 1994: Services to poor / disadvantaged
- Provision of sanitation included into our constitution
- Ventilated Improved Pit (VIP) latrine - basic minimum sanitation technology & roll-out
- Post 2000: Alternative technologies piloted
- Post 2010: Alternative “user acceptance” technologies
- Post 2013: Low water – No water / No sludge / beneficiation technologies


% Total Ascaris Ova/ 1 g UD Waste
90
80
70
60
50
40
30
20
10
0
top
middle
bottom
Layers of UD Waste
viable ova (% total ova count/ 1 g UD waste)
non-viable ova (% total ova count/ 1 g UD waste)

Overview

Technologies

Small-Scale Sewered Systems

Small Wastewater Treatment Plants

Integrated Algal Ponds Systems (IAPS)

Decentralised Wastewater Treatment Systems (DEWATS)

On-Site Systems

SASTEP

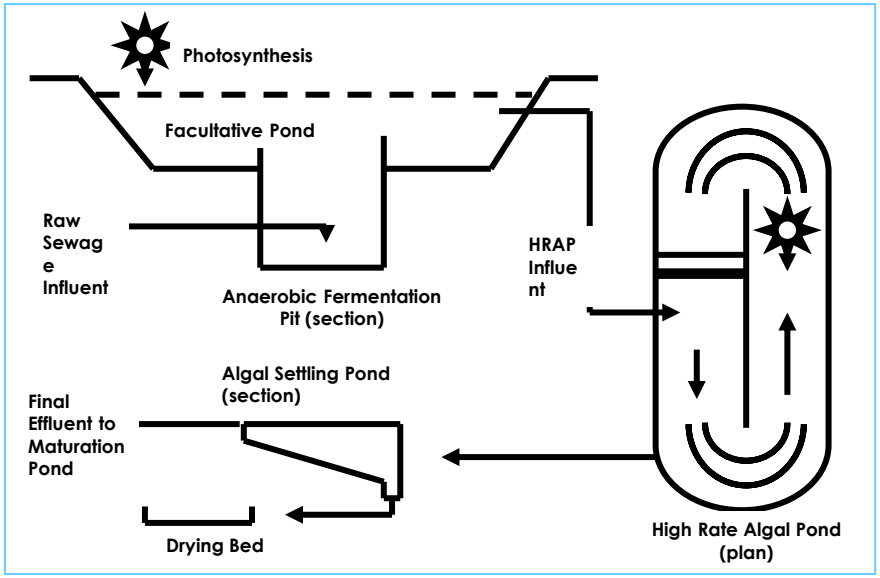
SRFA Project

Small-Scale Sewered Systems

Integrated Algal Ponds Systems

Project K5/2123

- IAPS commissioned in Belmont WWTW
- Low cost system that uses fermentation + algae + ponds
- Energy requirement low
- Algae generated envisaged as fertiliser substitute

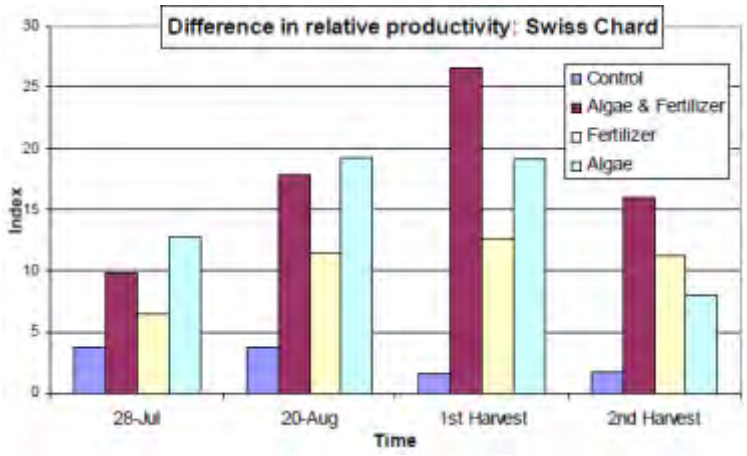


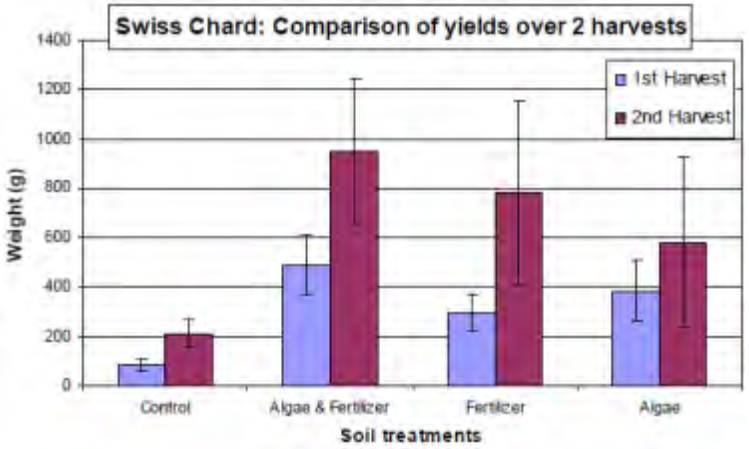
RHODES UNIVERSITY
Where leaders learn

Microalgae Biomass as Organic Fertiliser

RHODES UNIVERSITY
Where leaders learn

WATER RESEARCH COMMISSION





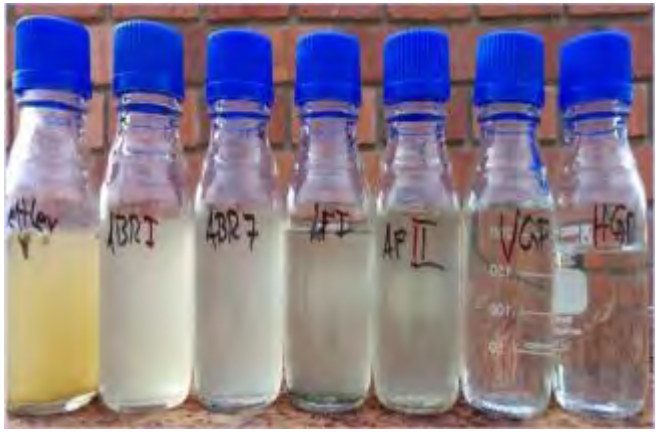
Control | Algae and Fertilizer | Fertilizer | Algae

Microalgae Biomass as Organic Fertiliser

DEWATS

Project K/2002

- Borda designed plant
- Settler+ABR+AF+Wetlands
- Improved performance after reconfiguration
- Agricultural trials on treated wastewater
- Research facility set-up by eThekwini Water and Sanitation unit



Waste to Agriculture

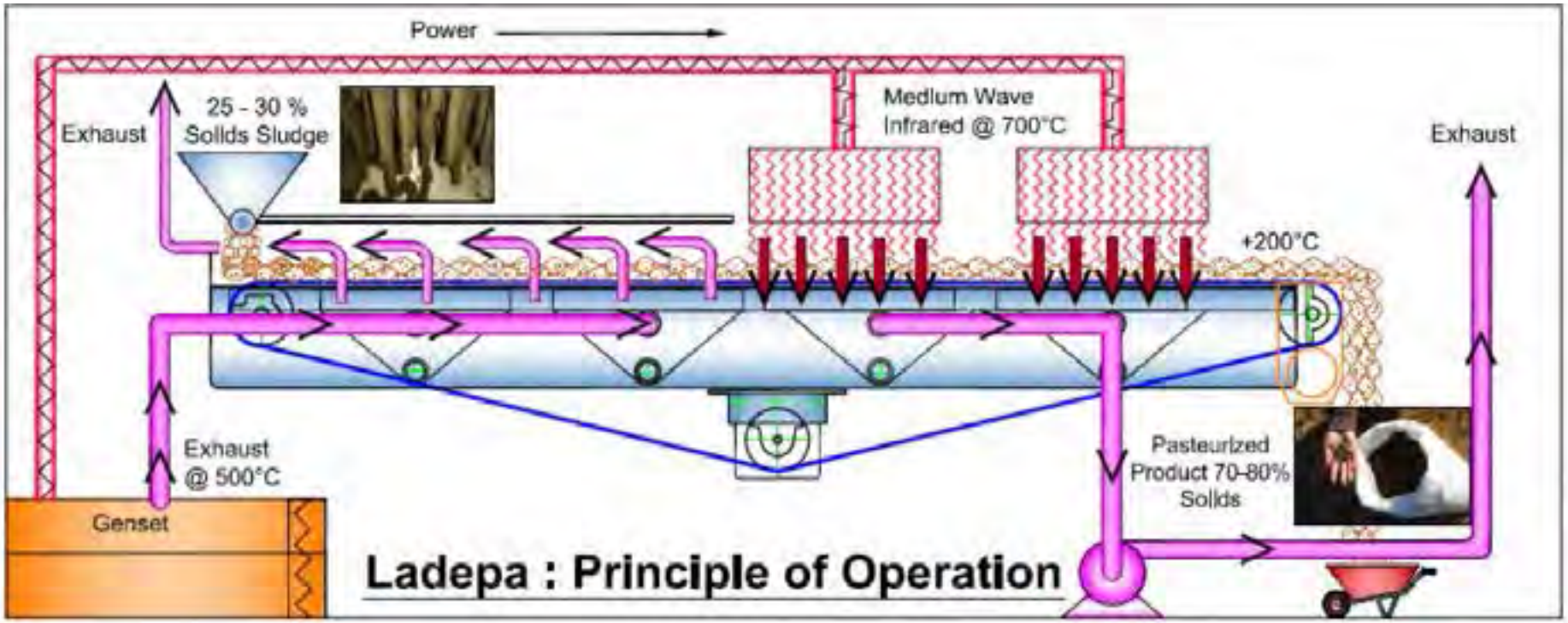
Project K/2220

- Integrating agriculture into design of on-site sanitation
- Effect of wastewater / sludge on soil chemical properties
- Different soils + crops + treatments
- Crop modelling

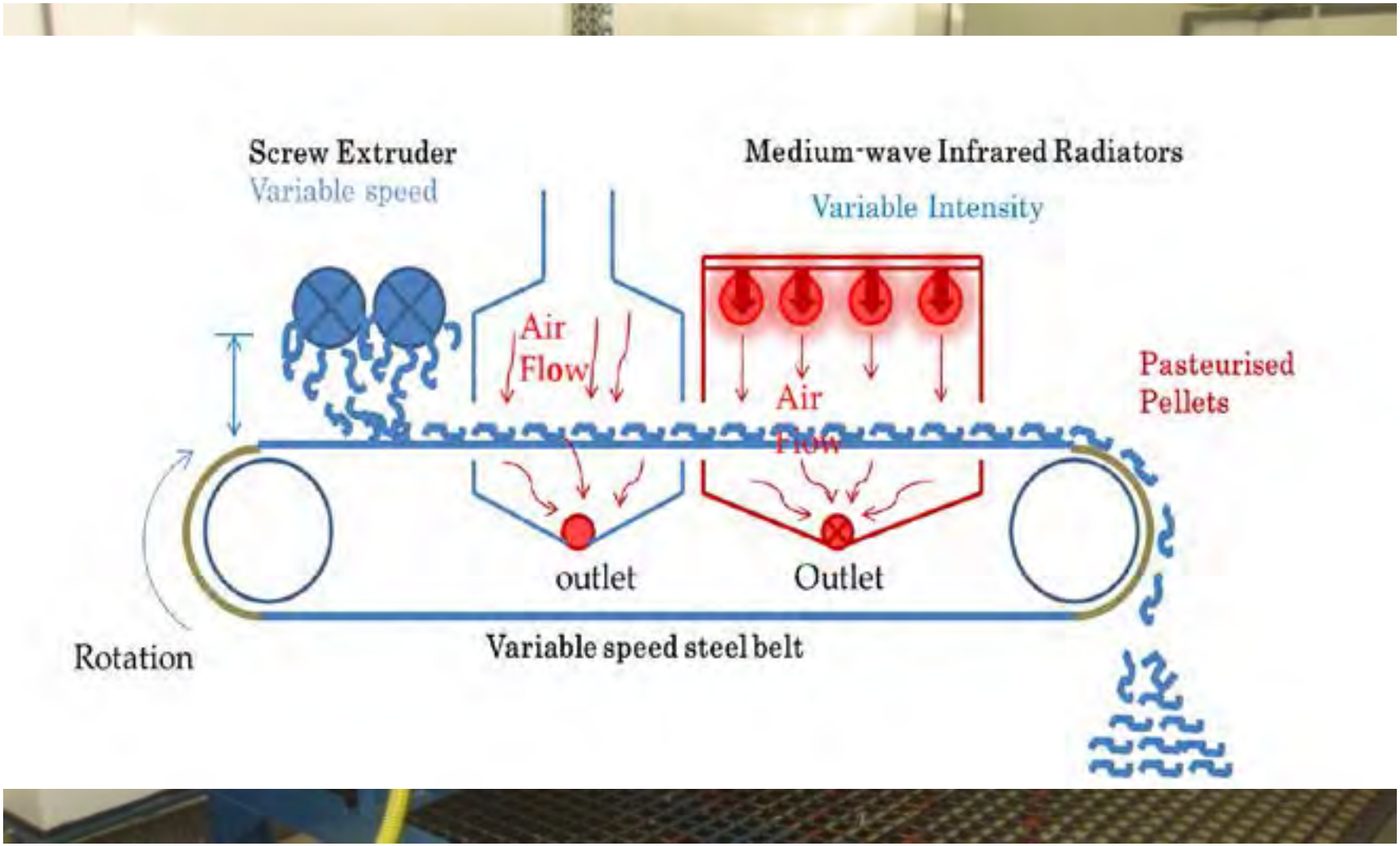
Technologies for On-Site Sanitation Beneficiation

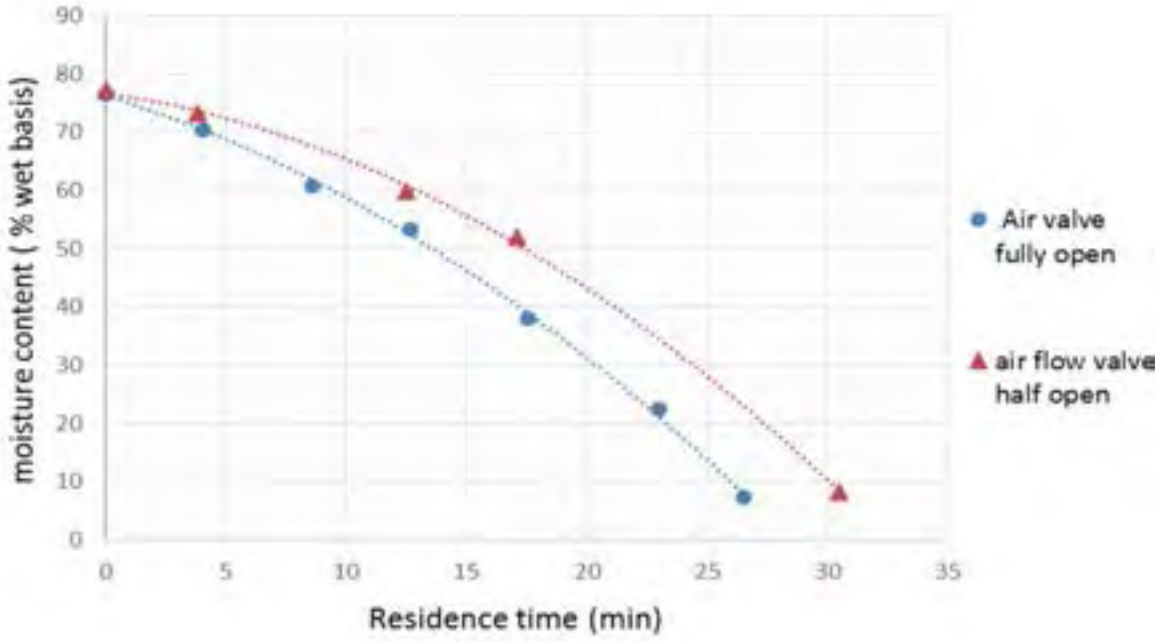
Project K5/2134: LaDePa

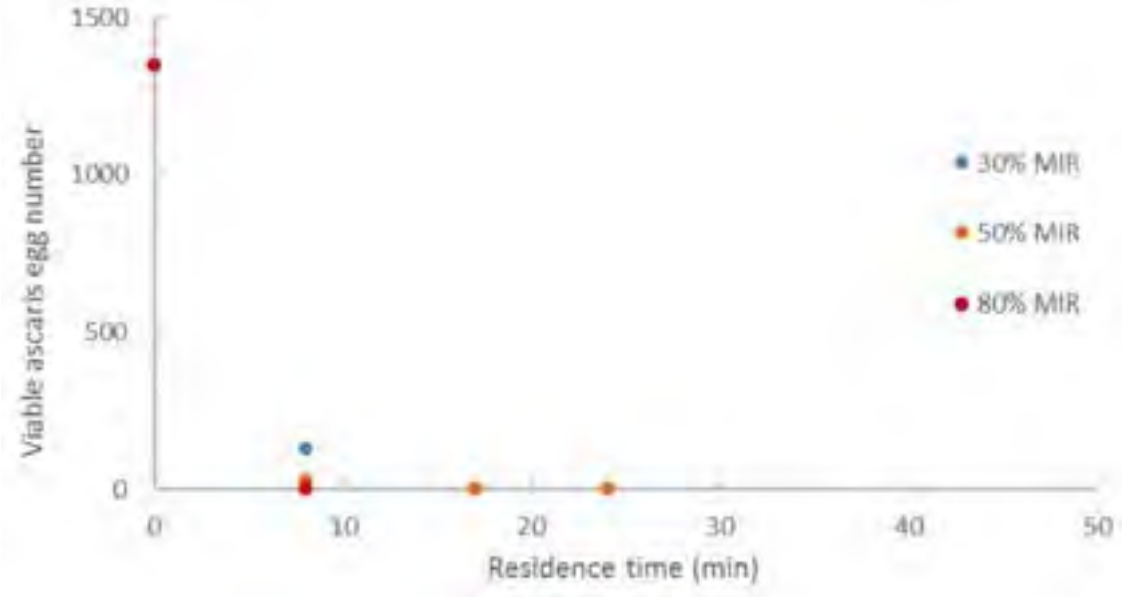
PRG
pollution research group


Power
Exhaust
25 - 30 %
Solids Sludge
Medium Wave
Infrared @ 700°C
Exhaust
+200°C
Exhaust
@ 500°C
Genset
Pasteurized
Product 70-80%
Solids
Ladepa : Principle of Operation

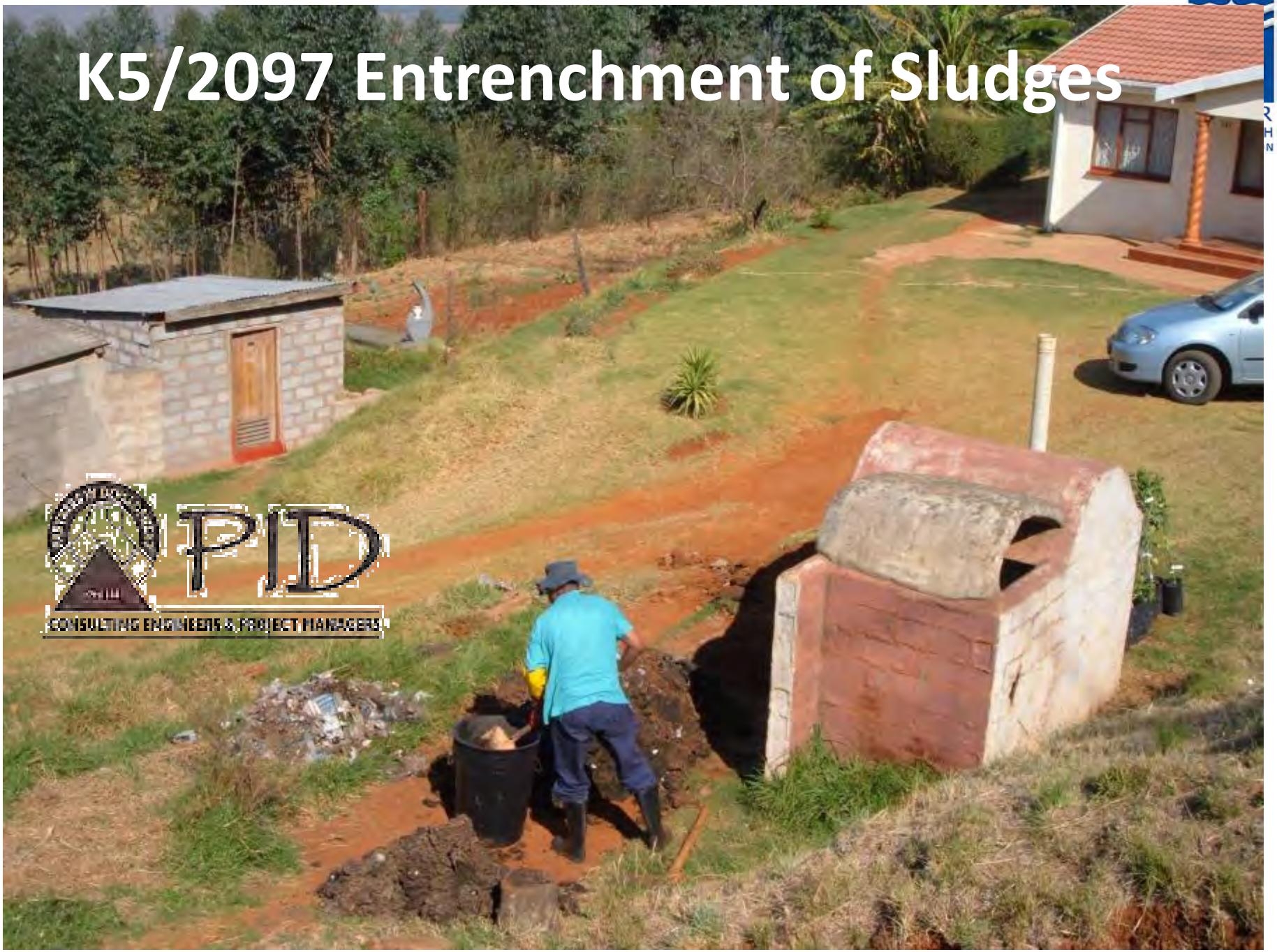
Baby LaDePa


Screw Extruder
Variable speed
Medium-wave Infrared Radiators
Variable Intensity
Air
Flow
Air
Flow
Pasteurised
Pellets
outlet
Outlet
Rotation
Variable speed steel belt


moisture content (% wet basis)
90
80
70
60
50
40
30
20
10
0
0
5
10
15
20
25
30
35
Residence time (min)
Air valve fully open
air flow valve half open


Viable ascaris egg number
1500
1000
500
0
0
10
20
30
40
50
Residence time (min)
30% MIR
50% MIR
80% MIR

K5/2097 Entrenchment of Sludges



Sludge burial research site - Umlazi


Umlazi Trial – sludge burial Jan 2009

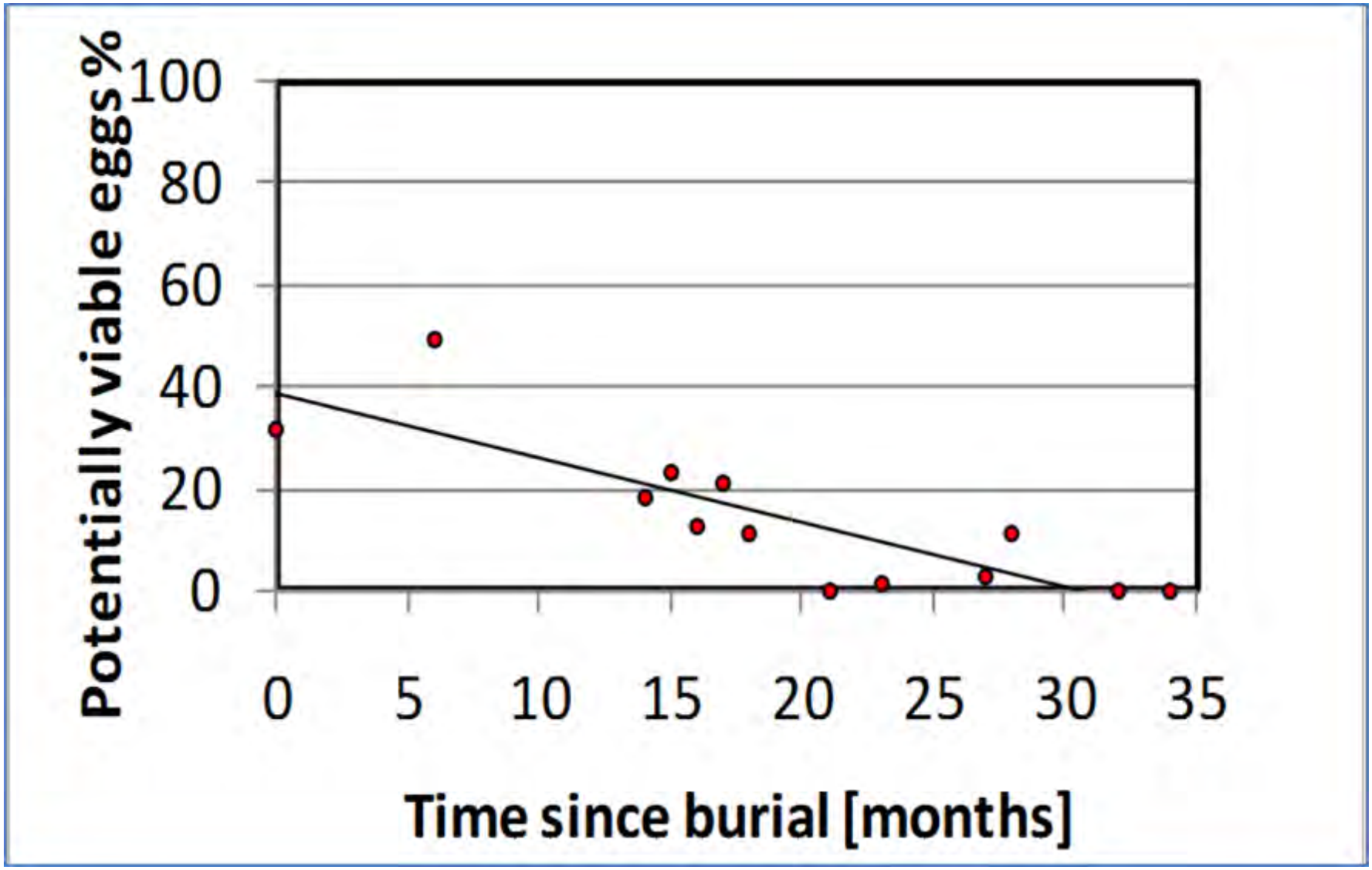
26 January 2012 –
three years after planting


Sludge January 2013

Monitoring of groundwater

- *E.coli*
- Heterotrophic plate count
- Nitrate
- Ammonium
- Chloride
- Sodium

Controlled trials at UKZN – after 6 months
Tree on left irrigated with fertiliser, tree on right planted over core of sludge



Fate of pathogens after burial

Do the tree roots avoid the sludge?

Controlled tower trial with VIP sludge, after 6 months

Sappi site

10 km west of Howick on Karkloof rd


220


ENGINEERING SOLUTIONS
FOR A BETTER FUTURE.
Roofkote

Controlled leachate monitoring trial, November 2013 - ?

Burial / Entrenching of Sludges

- Disposal on-site into a nearby pit or a trench is the simplest, cheapest and most practical option
- Plant a tree or trees over the sludge to gain some advantage from the nutrients in the sludge
- If you don't want to or can't bury the sludge, compost it
- In the ground, sludge decomposes by natural biological processes and after a few years is barely distinguishable from the surrounding soil.
- After three years even the hardiest pathogens such as *Ascaris* die off.
- Despite high loading rates no significant impact on groundwater has been observed in the trials to date over four years of monitoring.
- Shallow burial in conjunction with non-food crops (cane, timber) makes a good deal more sense than landfill

The Sanitation Research Fund for Africa (SRFA) Project

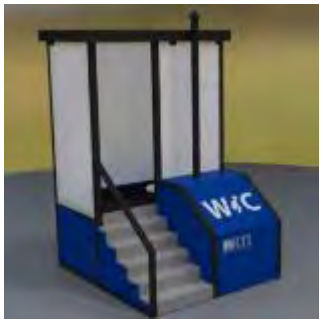
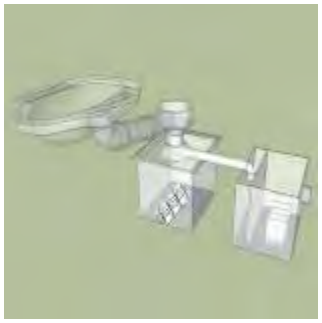
SASTEP

- Joint Programme: DST, BMGF and WRC
- Low / No Sludge Technologies + Products
- Operations & Maintenance learnings
- Performance evaluation
- Social aspects
- Economic aspects

science & technology
Department:
Science and Technology
REPUBLIC OF SOUTH AFRICA

RTTC Technologies

Technologies

RTI International	AIT	WEDC	Caltech	Fundación Terris
				
Auger Combustion Electrolysis	Hydrocyclone Pasteurization	Carbonisation	AD + electochemical cells	Auger Composting

Acknowledgements

science
& technology
Department:
Science and Technology
REPUBLIC OF SOUTH AFRICA