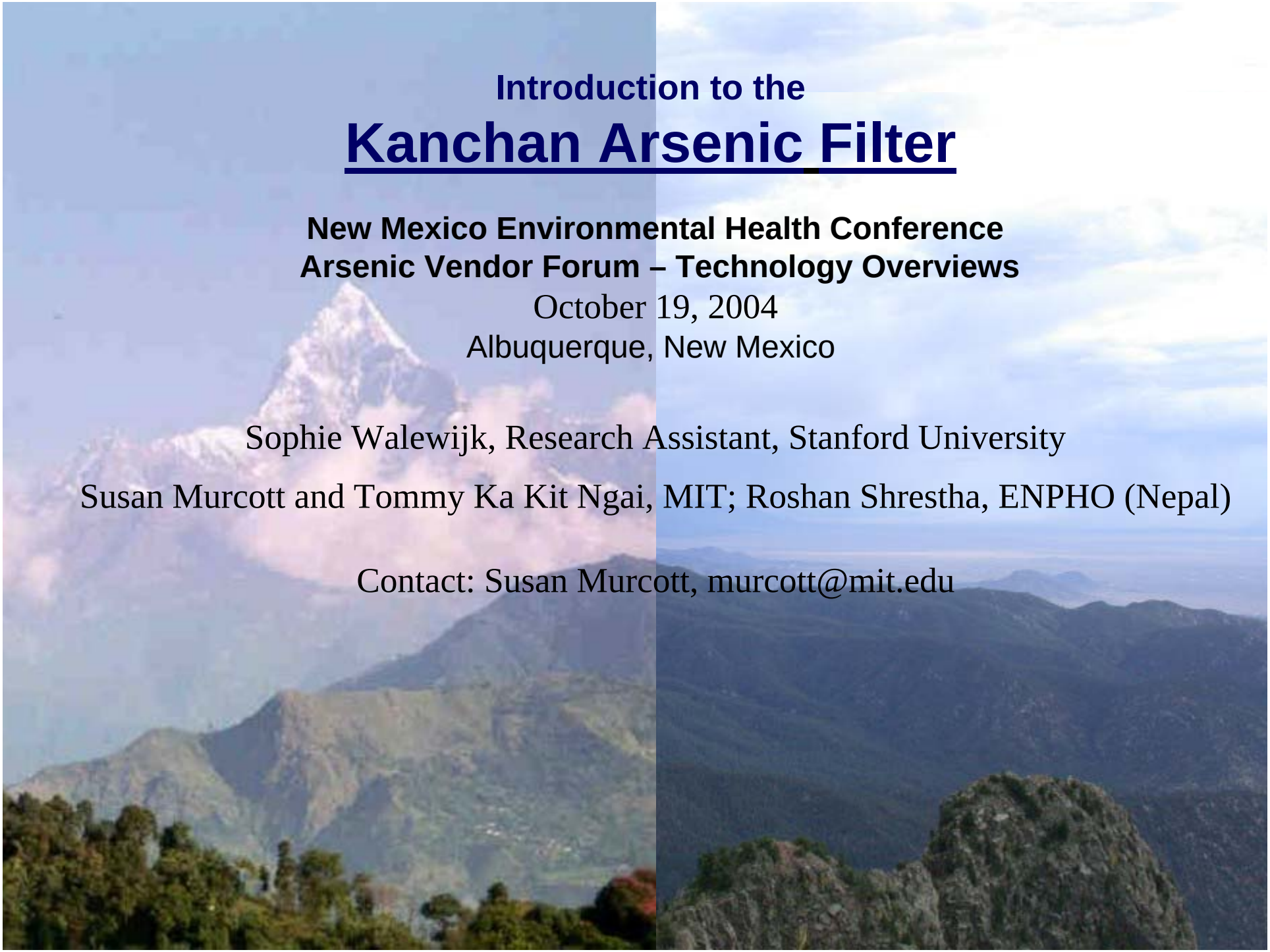


Introduction to the

Kanchan Arsenic Filter

New Mexico Environmental Health Conference
Arsenic Vendor Forum – Technology Overviews
October 19, 2004
Albuquerque, New Mexico

Sophie Walewijk, Research Assistant, Stanford University

Susan Murcott and Tommy Ka Kit Ngai, MIT; Roshan Shrestha, ENPHO (Nepal)

Contact: Susan Murcott, murcott@mit.edu

Our Team

Winners, 2003 Development Marketplace Competition, World Bank, Washington D.C.,

RWSSSP
(Rural Water Supply and Sanitation Support Program)

Tommy Ngai, MIT

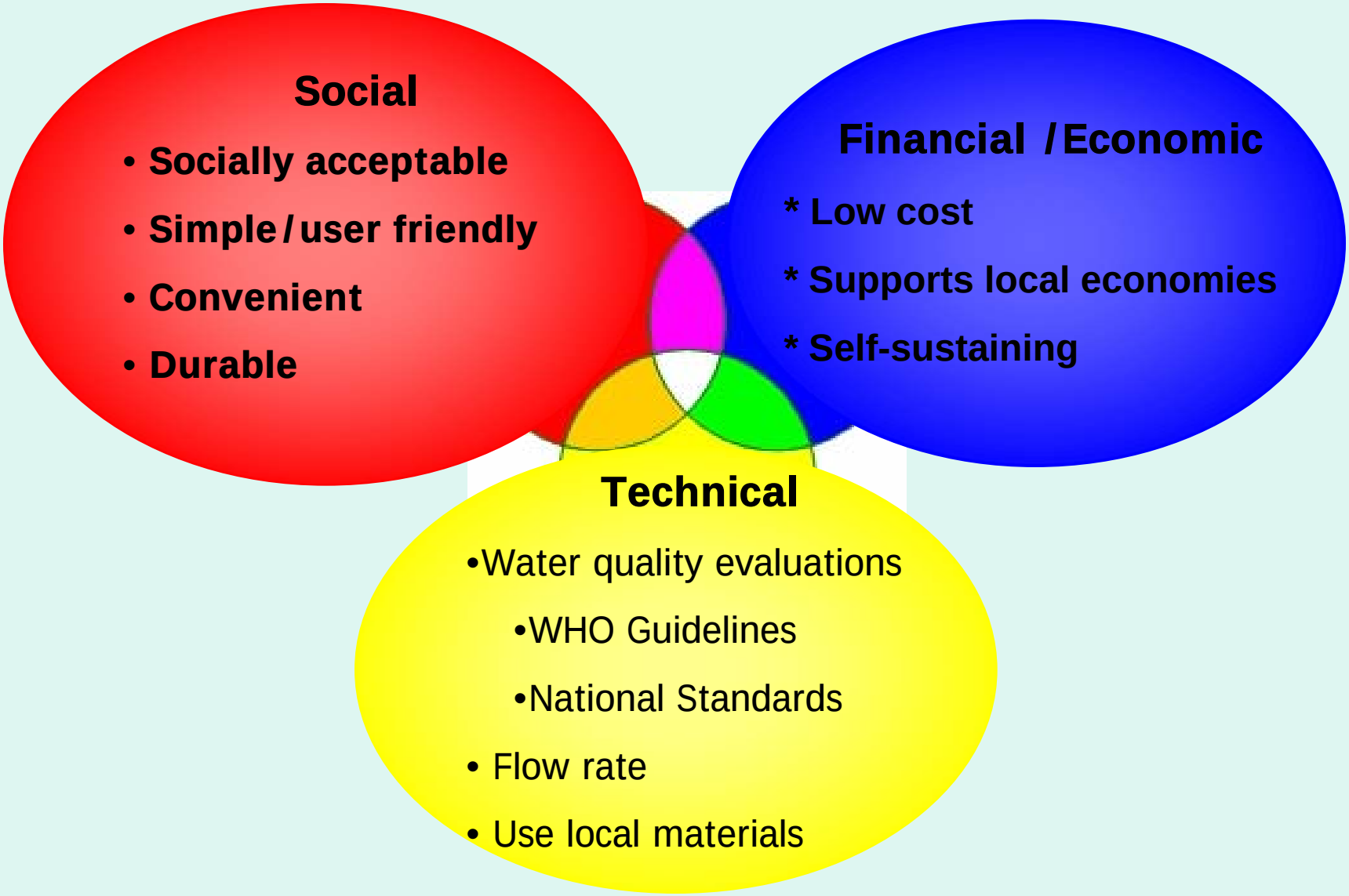
Roshan Shrestha, ENPHO, Nepal

Sophie Walewijk, Stanford

Susan Murcott, MIT

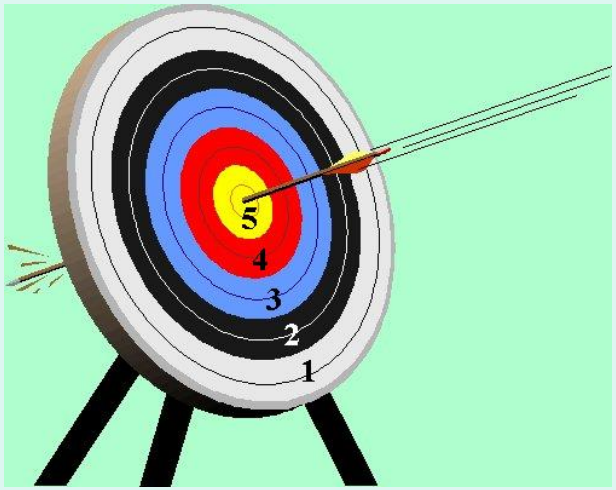
Designing for Rural (Developing) Communities

“Engineering design for sustainable development” framework

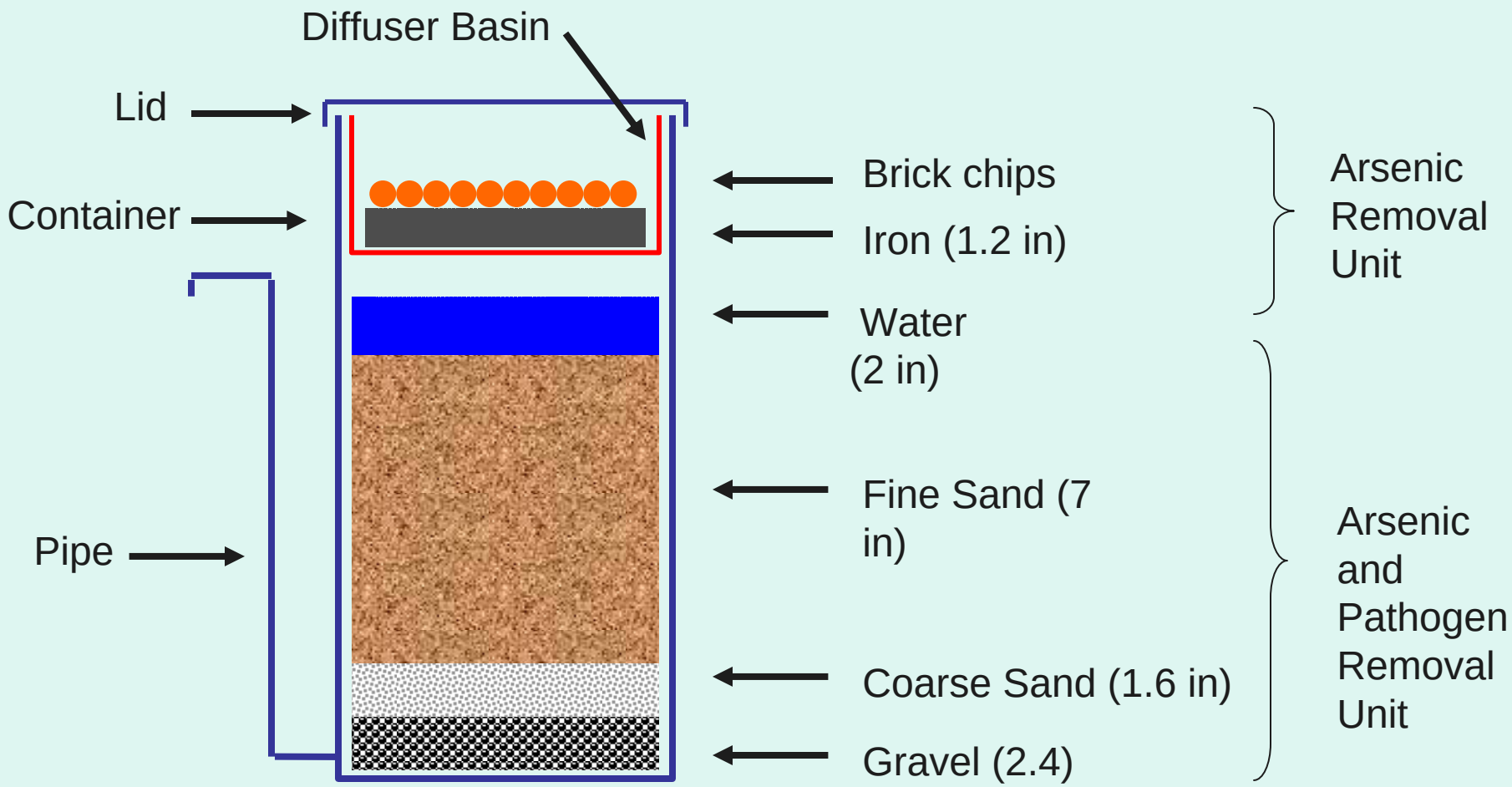


Outline

1. Introduction
2. The *Kanchan* Arsenic Filter
3. General Technical basis for the KAF technology
4. Advantages of the KAF
5. Field test results
6. Finances
7. Conclusions



Kanchan Arsenic Filter Cross Section

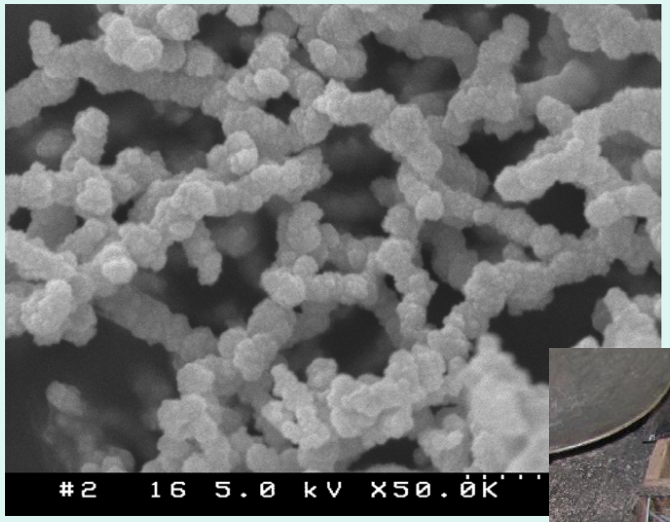


Filter Design

We have developed 4 configurations for the Kanchan Filter:

1. Concrete Square
2. Concrete Round
3. Plastic Hilltake
4. Plastic Gem505

Iron



Arsenic Removal Mechanism

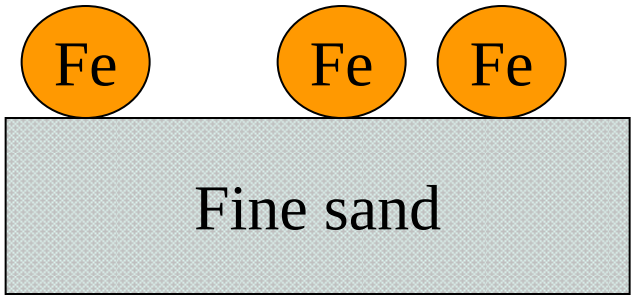
- After contact with water and air, iron nails in the diffuser basin will quickly rust

- Iron rust (ferric hydroxide) is an excellent adsorbent for arsenic

Iron Removal Mechanism

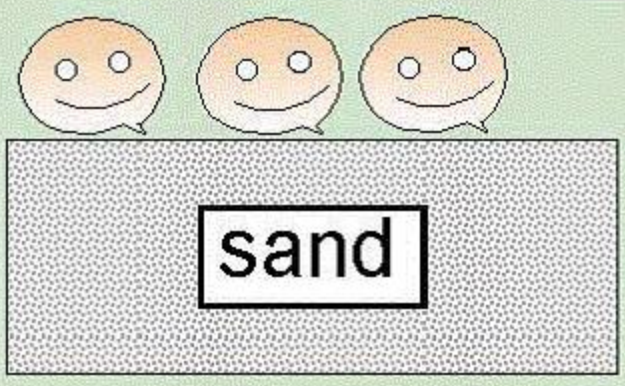
- Soluble iron(II) in raw water is oxidized in the filter to insoluble iron(III)

- Iron is trapped on top of sand layer by physical straining

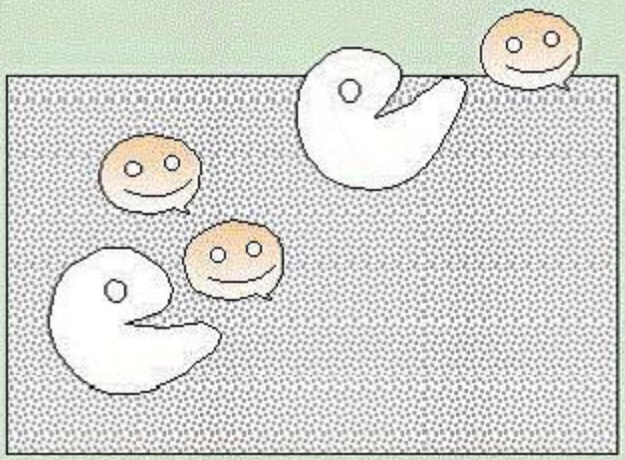


Iron particles are trapped on top of the fine sand layer by physical straining (i.e. too large to pass)

Bacteria Removal Mechanism



Larger pathogens will be trapped on top of the sand layer by physical straining.

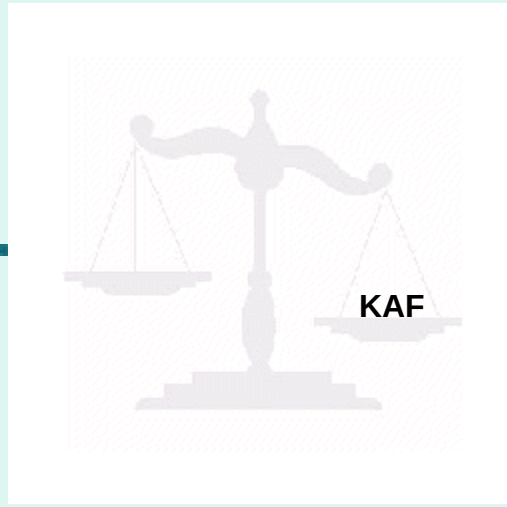


Smaller pathogens are removed by predation by microorganisms residing near the top sand layer.

Parameters

- Optimal pH: 6.5 – 8.5
- Optimal flowrate between 10 and 30 L/hr (2.5 – 7 gph)
- No regeneration required
- Removal of both arsenite and arsenate
- No pre- or post- treatment required
- Essentially no waste water

Other Advantages



1. Excellent arsenic removal
2. Cheap ($16.00)
3. No power requirements
4. Does not required extensive training
5. Easy to use, no additional steps, no time dependent, POU, respects local traditions and culture
6. Made with readily accessible materials
7. Removes both arsenic and bacteria
8. Extensive field studies performed

Technical Performance

- Currently more than 1000 filters are in operation (will be 2000 in December 2004)
- Filters were distributed starting from September 2002 until today
- We have monitored 800+ filters between February to May 2004 on arsenic and iron removal
- The average time between filter installation date and filter monitoring date is 93 days

AKF Blanket Monitoring

Arsenic Removal (n=644)

Effluent Arsenic Concentration (ppb)

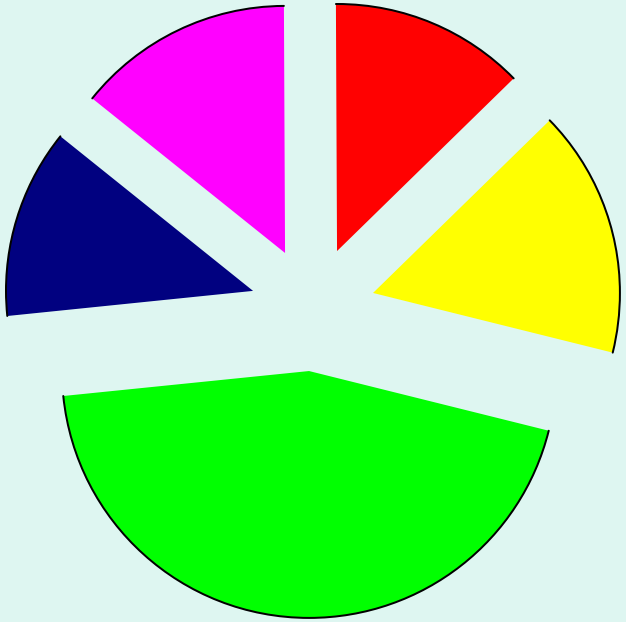
Influent Arsenic Concentration (ppb)	500	450	400	350	300	250	200	150	100	90	80	70	60	50	40	30	20	10	ND	
500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	5	8
450		3	1	1	1	0	0	0	1	0	0	0	0	0	0	3	2	1	8	21
400			1	0	0	1	0	1	0	0	0	0	0	0	2	1	2	2	7	17
350				0	0	0	0	0	0	0	0	0	0	0	1	3	1	3	14	22
300					0	1	0	0	0	0	0	0	0	0	1	1	3	1	17	24
250						2	1	0	0	0	1	0	0	2	2	2	1	1	23	35
200							2	0	1	0	1	0	0	0	0	0	0	1	23	28
150								1	0	0	0	0	0	0	1	0	1	1	14	18
100									0	0	0	1	0	0	1	1	3	8	76	90
90										1	0	2	1	0	0	0	3	6	53	66
80											0	0	0	0	0	1	0	1	43	45
70												0	0	0	0	1	0	2	36	39
60													0	0	1	2	5	13	29	50
50														0	0	0	1	3	49	53
40															0	0	0	2	15	17
30																0	0	0	14	14
20																	0	0	19	19
10																		0	10	10
ND																			68	68
	0	3	2	1	1	4	3	2	2	1	2	3	1	2	10	15	22	47	523	

Unacceptable
Acceptable

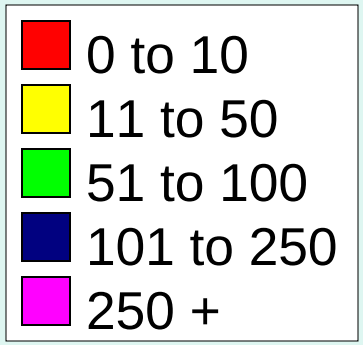
Figure indicates number of filters

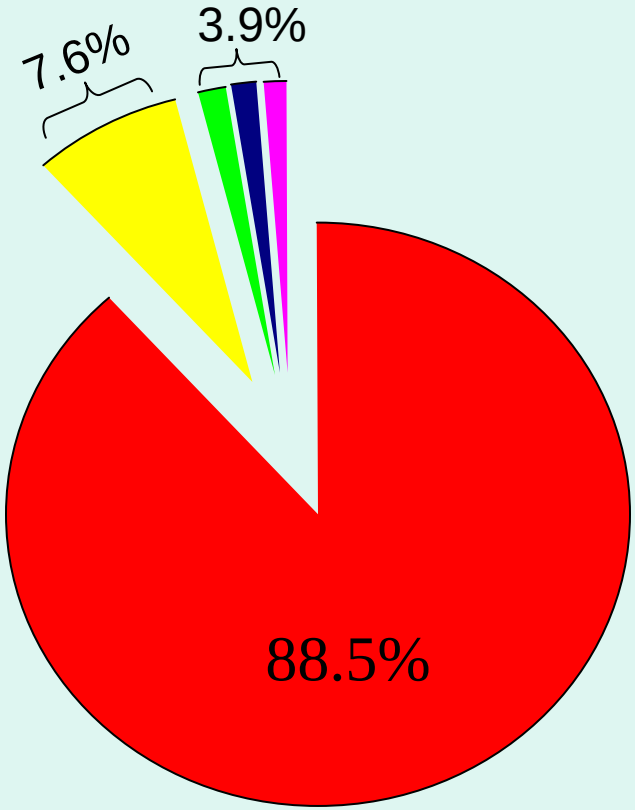
AKF Blanket Monitoring

Arsenic Removal (n=644)



Influent Arsenic
Concentration (ppb)





Effluent Arsenic
Concentration (ppb)

Filter Design

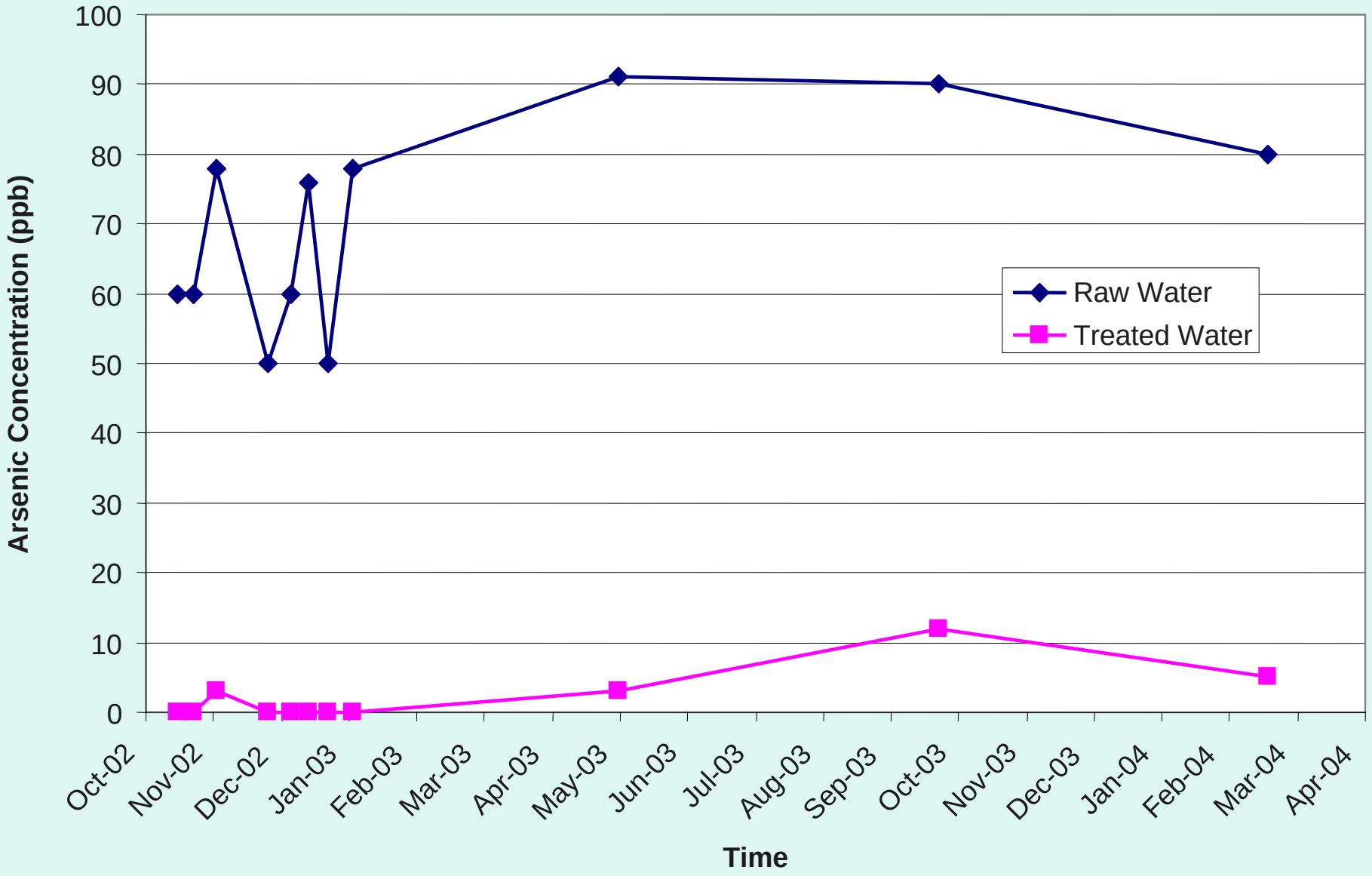
We have developed 4 configurations for the Kanchan Filter:

1. Concrete Square
2. Concrete Round
3. Plastic Hilltake
4. Plastic Gem505

After one month:
Influent: 500, 400, 400, 350, 250, 250 ppb
Effluent: <10ppb

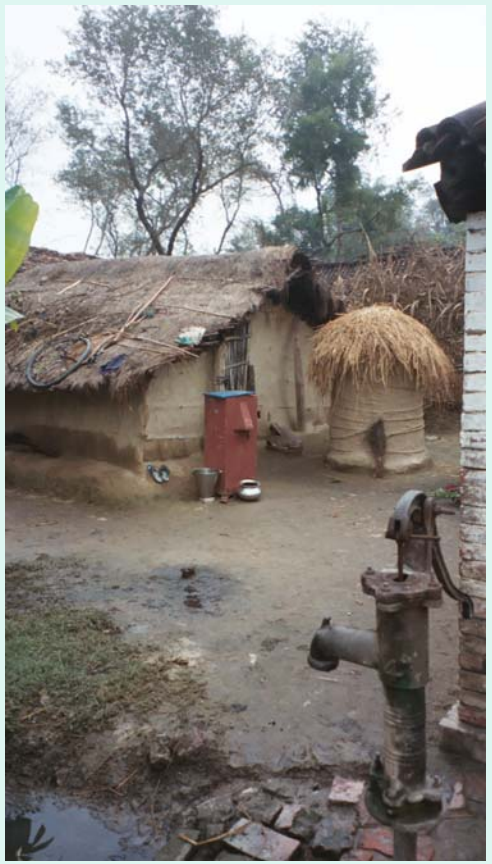
1.5 Years Arsenic Monitoring on Filter A

(Nim Narayan Chaudhary)



Conclusions

- Great arsenic removal
- Optimal pH: 6.5 – 8.5
- Flow rates: 2.5 – 7 gph
- POU
- No pre-treatment and minimal waste
- Cheap
- Independent



Thank You.
Any Questions?

http://ceeserver3.mit.edu/~water/