Arsenic Contamination & Findings of Arsenicosis Patients in Patkhauli Village of Nawalparasi District and Other Parts of Nepal

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Environment & Public Health Organization (ENPHO)

Arsenic ?

- Arsenic is a metalloid toxic element also called “Secrete Poison”
- It can be found in water, air, food, soil etc.
- The total daily intake of Arsenic by the general population is usually less than 0.2 mg/day.
- Exposure to arsenic through ingestion occurs mainly by drinking As contaminated water.
- WHO standard for Arsenic in drinking water 10 ppb and Nepal – 50 ppb
- Symptoms of Arsenic toxicity can be observed within 2 to 10 years of exposure. However it depends upon the exposure level, nutritional status, metabolism and genetic factor of individual.

Release of Arsenic Contamination in Groundwater

- Not clearly known
- Natural geological changes are presumed to be the primary reason for arsenic contamination
- Arsenic Release Mechanism in groundwater
  1. Oxidation of Arsenic Bearing Minerals

     (Arsenopyrite – FeAsS)
  2. Natural Process – Oxyhydroxide reduction”
  3. Anthropogenic causes

Clinical Feature of Arsenicosis Patient

Pre Clinical Stage

Not detectable by clinical manifestation

Initial Stage

Melanosis, Keratosis, Bronchitis, Gastroenteritis

Clinical Feature (……. Cont)

Second Stage

Depigmentation – rain drop pigmentation,
Hyperkeratosis, Oedma of legs……

Clinical Feature (……. Cont)

Last Stage

Gangrene, Cancer (skin, bladder and lung)….

RWSSFDB RWSSSP

NRCS

NEWAH

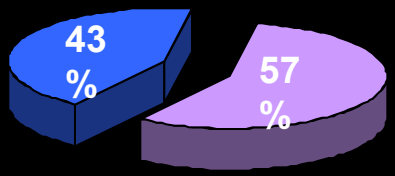
DWSS

Total Arsenic tested tube wells

18,635

- Well ID
- Location information
- Geographic coordinate
- Depth of well
- Age of well
- Users information
- Arsenic concentration
- Test method
- Microbiological result
- Data Source

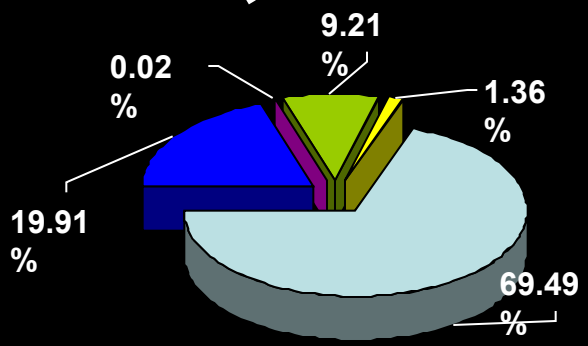
Location Information



With coordinate

Without Coordinate

Test Method



AAS

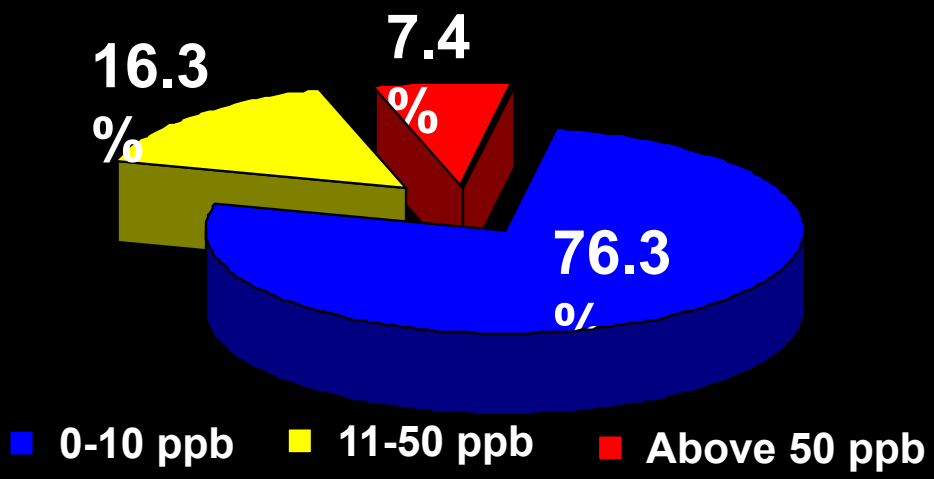
ENPHO

HACH

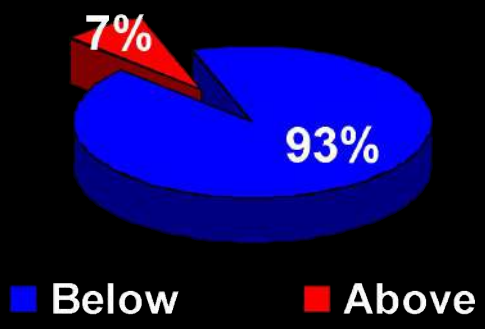
INDIAN

Unknown

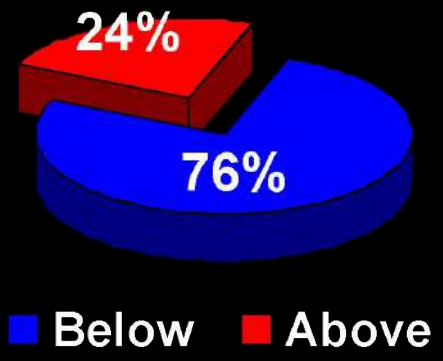
Classification of Arsenic Concentration



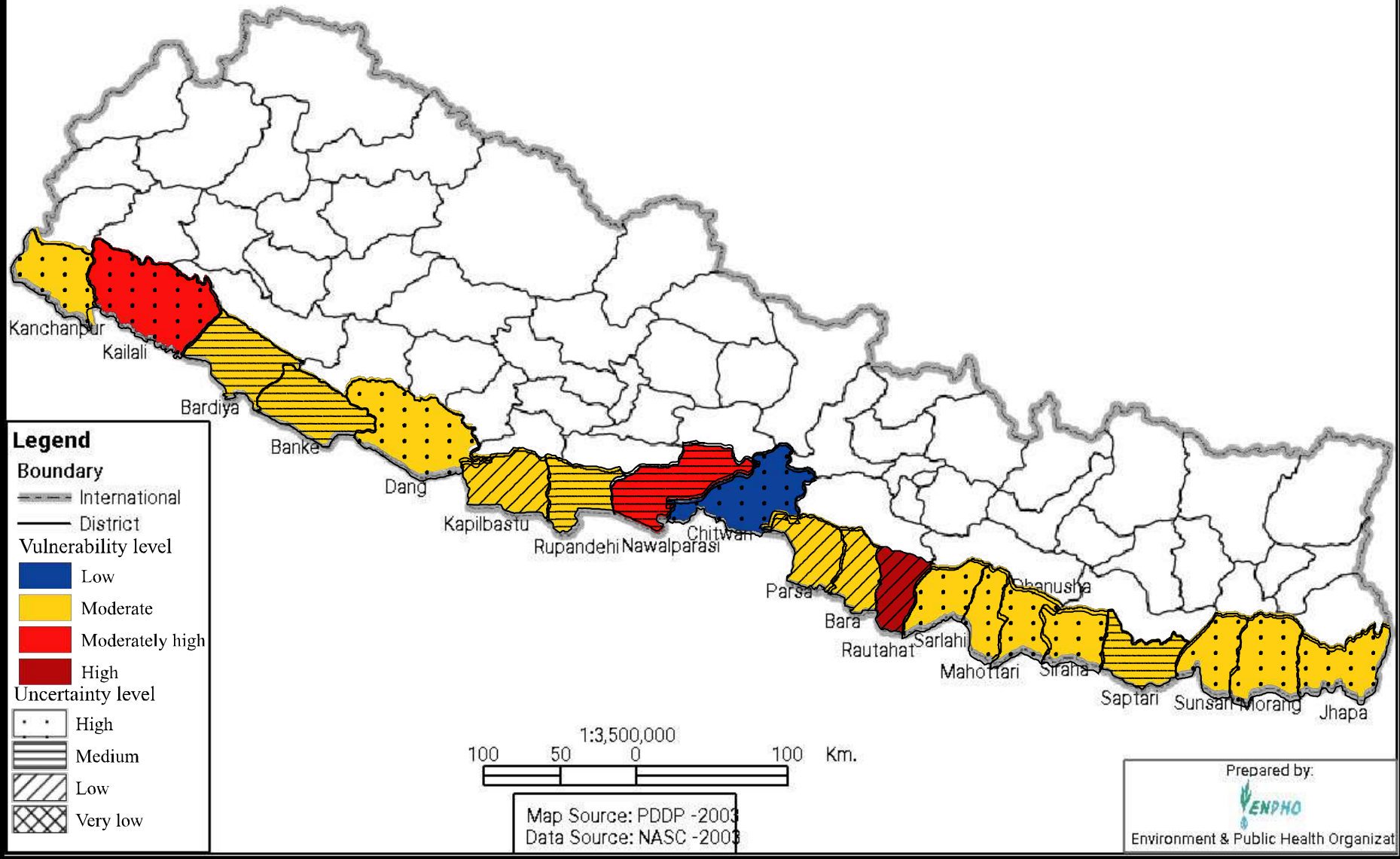
Nepal Interim Standard



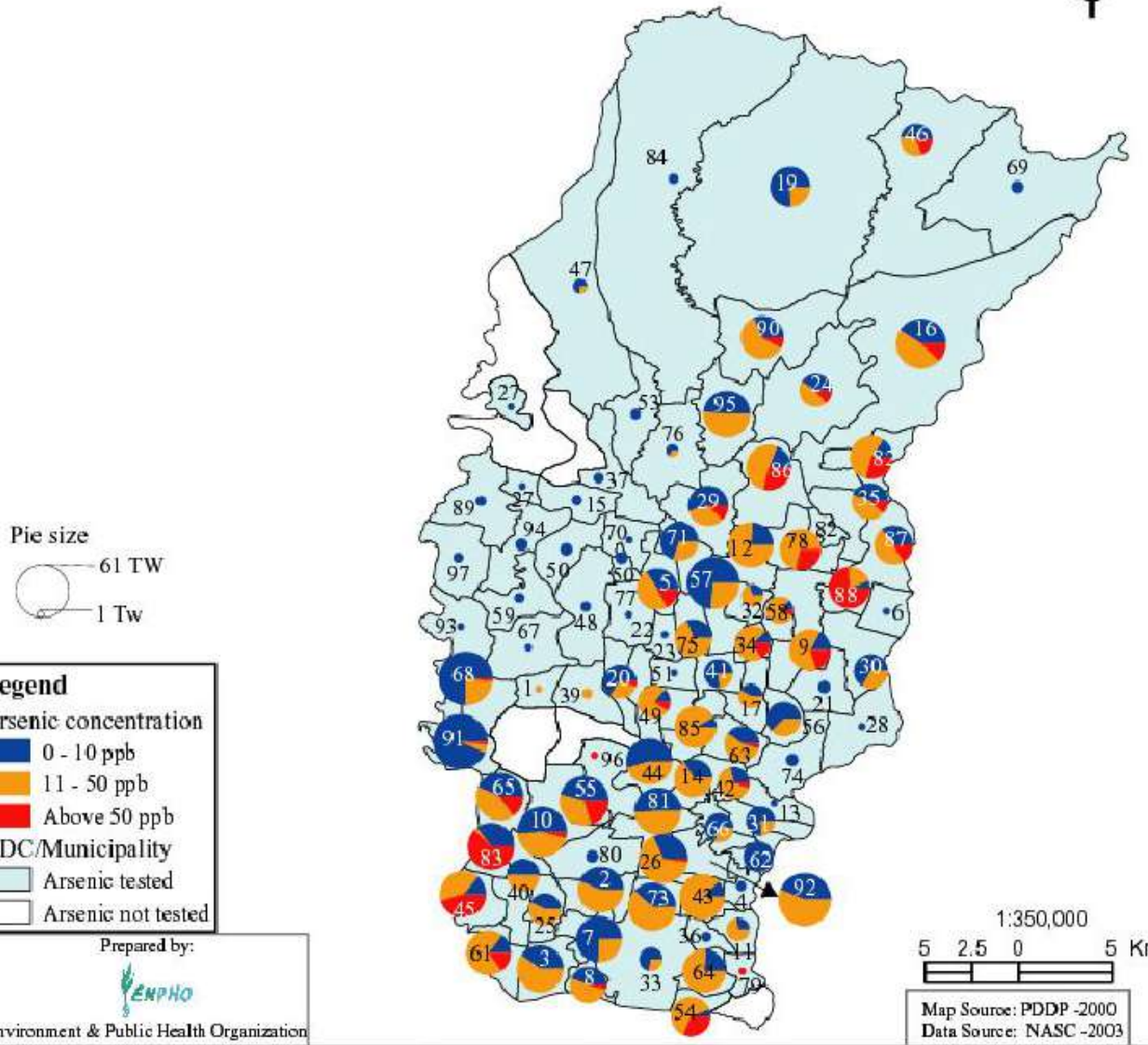
WHO Guideline



Drinking Water Vulnerability to Arsenic - Terai

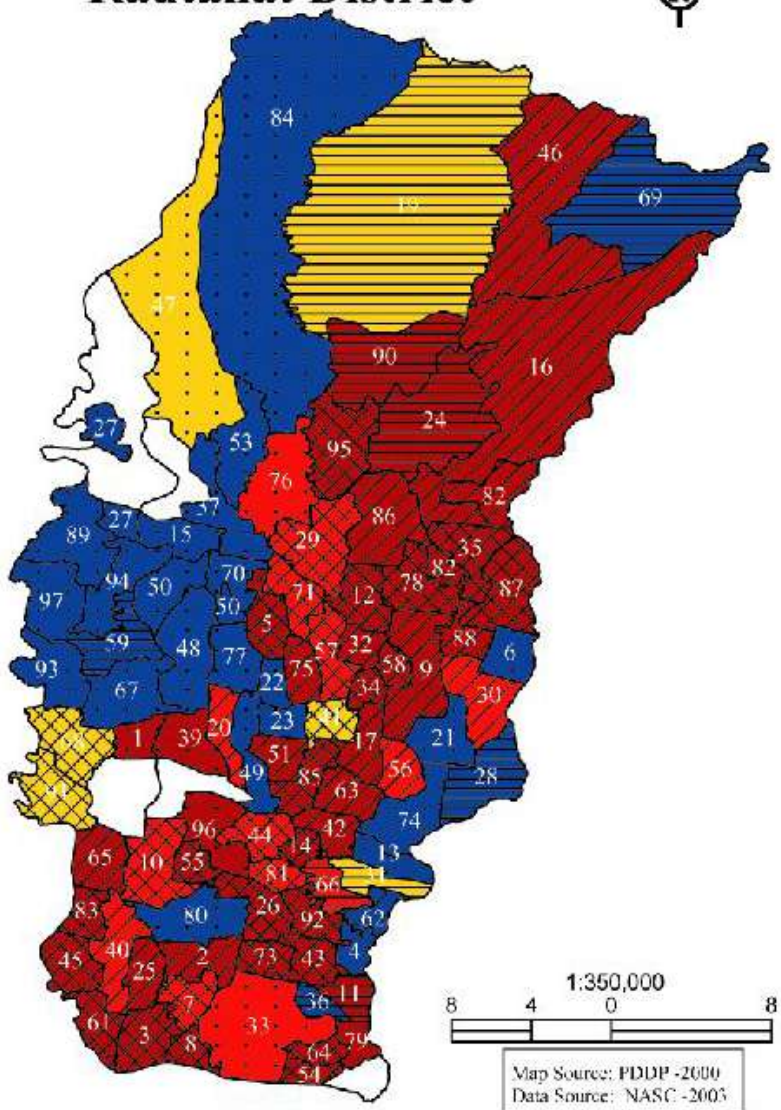


Classification of Arsenic Concentration Rautahat District



Code	Name	Code	Name
1	Ajagabi	49	Karuniya
2	Akolawa	50	Katahariya
3	Auraiya	51	Khesarhiya
4	Badharwa	53	Laxmipur (DO)
5	Bagahi	54	Laxmipur Belbichawa
6	Bahuwa Madanpur	55	Lokaha
7	Bairiya	56	Madhopur
8	Banjaraha	57	Mahamadpur
9	Bariyarpur	58	Malahi
10	Basantapatti	59	Marayadpur
11	Basatpur	61	Mathiya
12	Basbiti Jingadiya	62	Matsari
13	Bhalohiya (Pipra)	63	Mithuawa
14	Bhediyahi	64	Mudwalawa
15	Birtiprastoka	65	Narkatiya Guthi
16	Bishrampur	66	Pacharukhi
17	Bisunpurwa Manpur	67	Pataura
19	Chandranigahapur	68	Pathara Budharampur
20	Debahi	69	Paurai
21	Dharampur	70	Pipara Pokhariya
22	Dharhari	71	Pipariya (Dostiya)
23	Dipahi	73	Pipra Bhagwanpur
24	Dumariy (Matiauna)	74	Pipra Rajbara
25	Dumriya (Paroha)	75	Pothiyahi
26	Fatuha Maheshpur	76	Pratappur Paltuwa
27	Fatuwa Harsaha	77	Prempur Gunahi
28	Gadhi (Bhanawanpur)	78	Raghunathpur
29	Gambhariya Birta	79	Rajdevi
30	Gambhariya Parsa	80	Rajpur Farhadawa
31	Gangapipra	81	Rajpur Tulsi
32	Garuda Bairiya	82	Ramoli Bairiya
33	Gaur N.P.	83	Rampur Khap
34	Gedahiguthi	84	Rangapur
35	Hadirya Paltuwa	85	Sakhuawa
36	Hajminiya	86	Sakhuwa Damaura
37	Hathiyahi	87	Samanpur
39	Inaruwa	88	Sangrampur
40	Jatahara	89	Santapur (Dostiya)
41	Jayanagar	90	Santpur (Matiaun)
42	Jethrahiya	91	Sarmujawa
43	Jhunkhunwa	92	Saruatha
44	Jingadawa Belbichwa	93	Saunaraniya
45	Jowaha (Jokaha)	94	Sitalpur Bairgania
46	Judibela	95	Simara Bhawanipur
47	Kakanpur	96	Tejapakar
48	Karkach Karmaiya	97	Tengraha

Drinking Water Vulnerability to Arsenic
Rautahat District



Legend

Vulnerability level
- Low
- Moderate
- Moderately high
- High

Uncertainty level
- High
- Medium
- Low
- Very low

Prepared by:
ENPHO
Environment & Public Health Organization

Map Source: PDDP -2000
Data Source: NASC -2003

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35	Hadirya Paltuwa	85	Sakhuwa
36	Hajiriniya	86	Sakhuwa Damauna
37	Hathuyahi	87	Samanpur
32	Inaruwa	88	Sangrampur
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48	Karkach Karmaiya	97	Teneraha

Health Impact Study in the Arsenic affected Areas of Nepal

Dr. Mathura Prasad Shrestha

Senior Health Advisor

(Drinking Water Quality Improvement Program- NRCS/ENPHO)

Findings

Health Survey Results

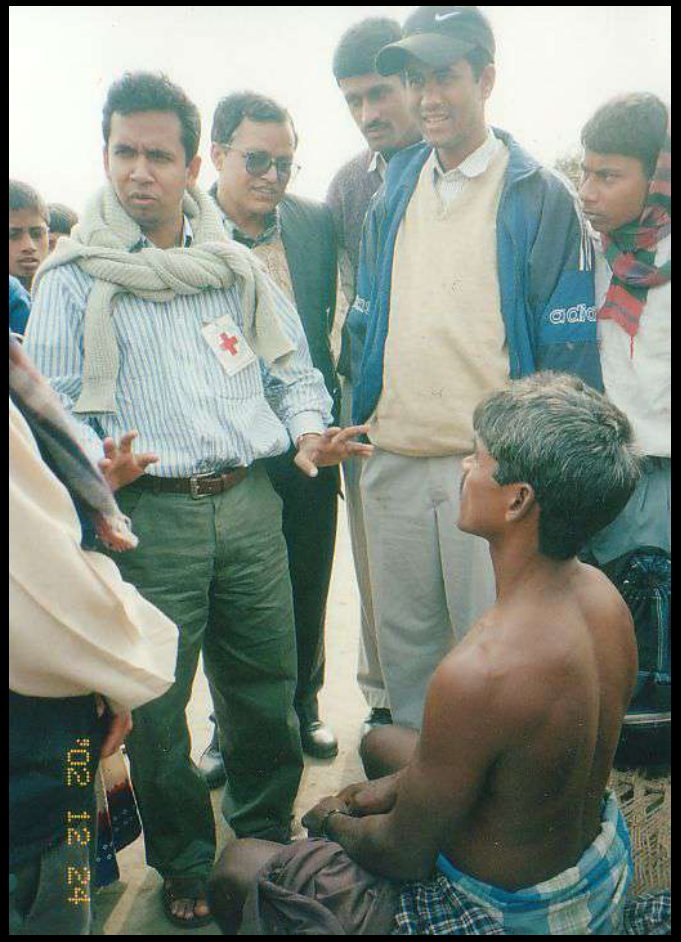
Health Survey was done by NRCS,DWSS and FINNIDA in its project areas

Note: Tube wells that had arsenic >50ppb were only considered for the study. Thus the entire population is not covered or population consuming from particular tube well is only covered

Pictures

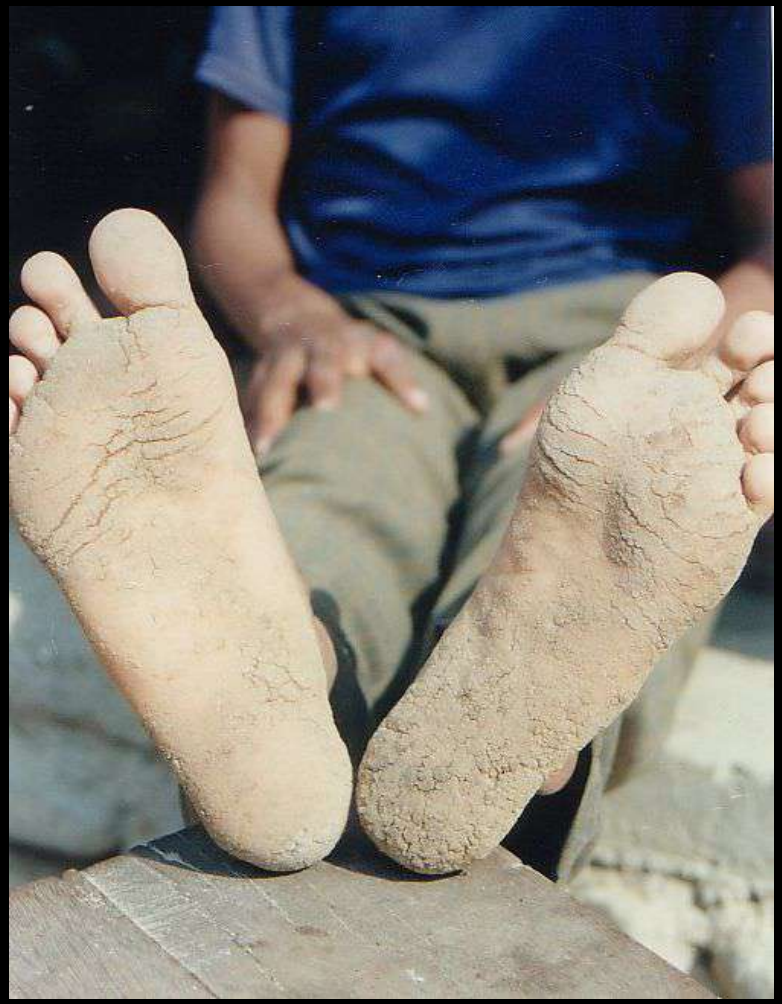

H

Medical Doctor from Bangladesh confirming the suspected patients in Nawalparasi

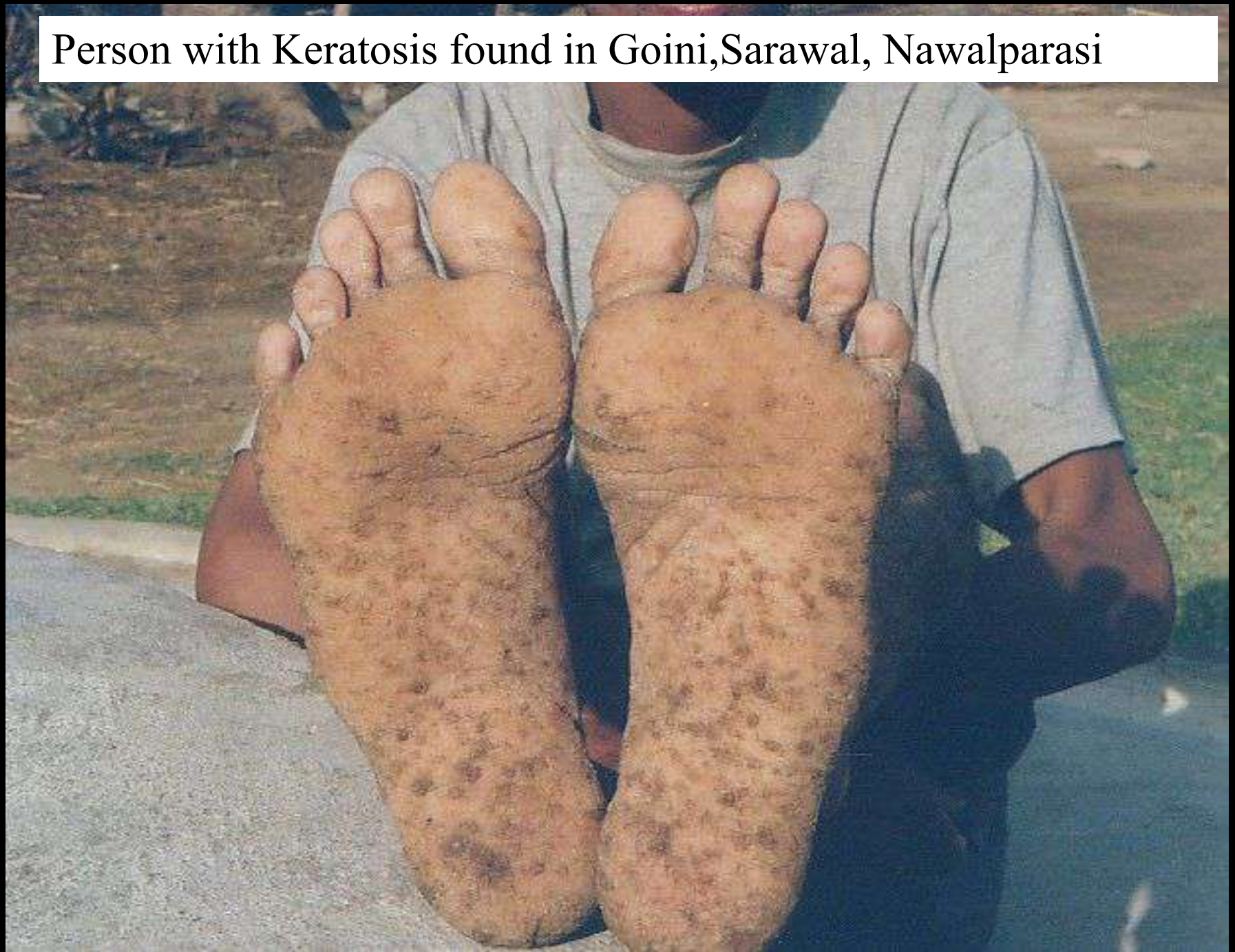


Person with Melanosis found in Parsa District

Person with initial stage of Keratosis found in Parsa District



Person with Keratosis found in Goini,Sarawal, Nawalparasi




Keratosis in sole,Goini
'02 12 24


Keratosis in palm,Goini


Keratosis in palm,Goini

Keratosis in sole,Goini

Keratosis in palm and sole,Goini

Health Worker giving consultation to affected household

Prof Tani.....

Mitigation Program

No

Yes

Yay

No

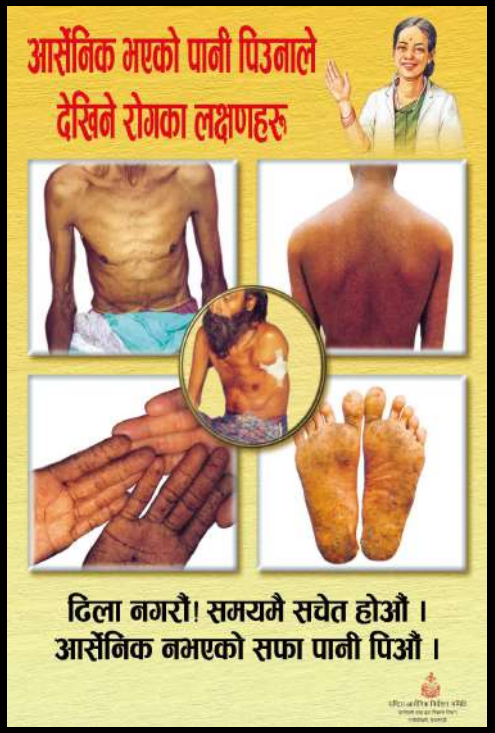
No

Yes

Yes

No

रामप्यारी घरमा गइन् र ट्युबवेलको पानी खिचिरहेका आफ्नो बुबालाई शंकालु मनले भनिन् "बुबा ! हाम्रो ट्युबवेलको पानी खानयोग्य छ होला ?" उनको बुबाले भने "हाम्रो पोहोर मात्र त्यत्रो पैसा खर्चेर अनुभवी मिस्त्रीले गाडेको र यस ट्युबवेलको वरीपरि सिमेन्ट समेत लगाएको हुँदा खानयोग्य नहुने त कुरै छैन।"

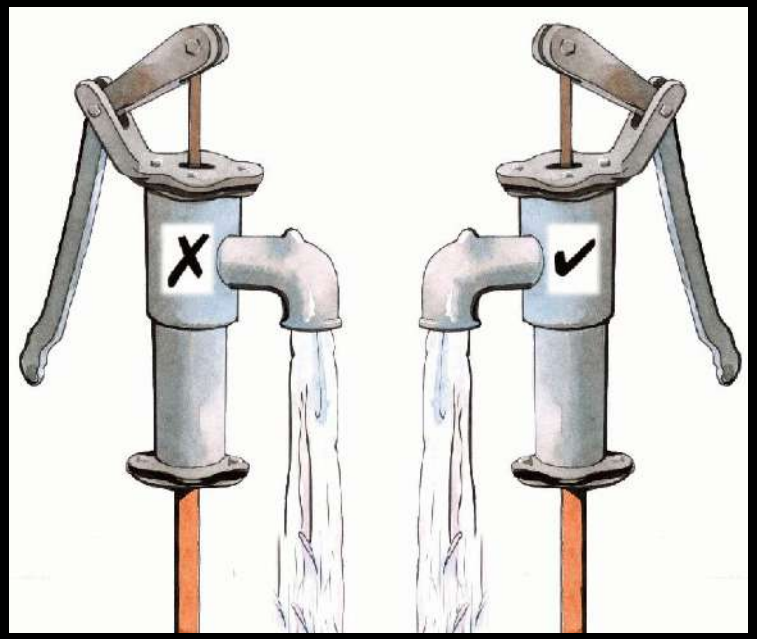


More Testing

- NASC has already tested 339515 Tubewells
- 3 % more than 50 ppb
- About 15 % more than WHO limit

Alternative Options

Marking Tube-well



Dugwell as alternative option


AIRP

Community level Arsenic Removal Treatment Plant under construction (Nawalparasi)

Arsenic- Iron Removal Plant in Badera VDC in Nawalparasi

Household Arsenic Removal Filters

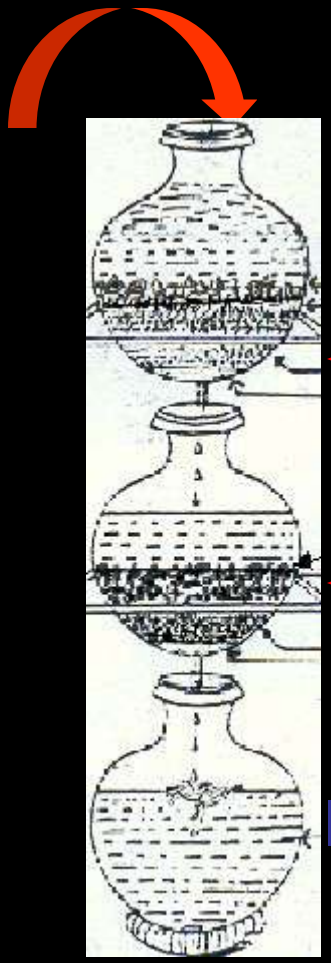
ENPHO Two Gagri Filter

Chemical packet contains:

- Ferric chloride (coagulant)
- Sodium hypochlorite (oxidant)
- Charcoal (adsorbent)


8 30 '01

Three-Gagri System



Brick chips 1.0 kg, iron nail 2.5 kg and coarse sand 2 kg

Brick chips 1kg charcol 1 kg & Fine sand 2kg

Clean water


Hilltake
USE ME

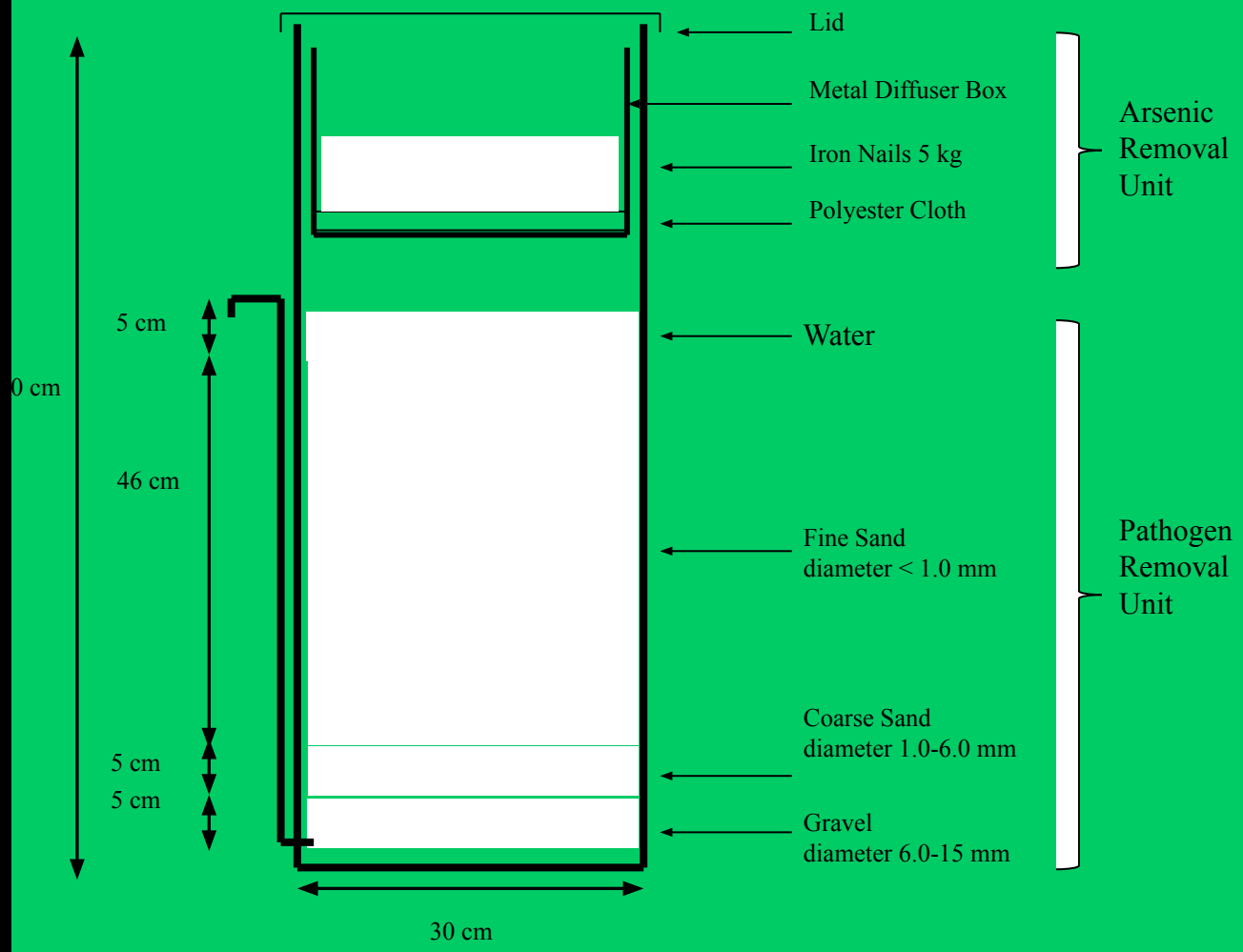

कंचन फिल्टर


Development Marketplace 2003
WINNER
The World Bank Group

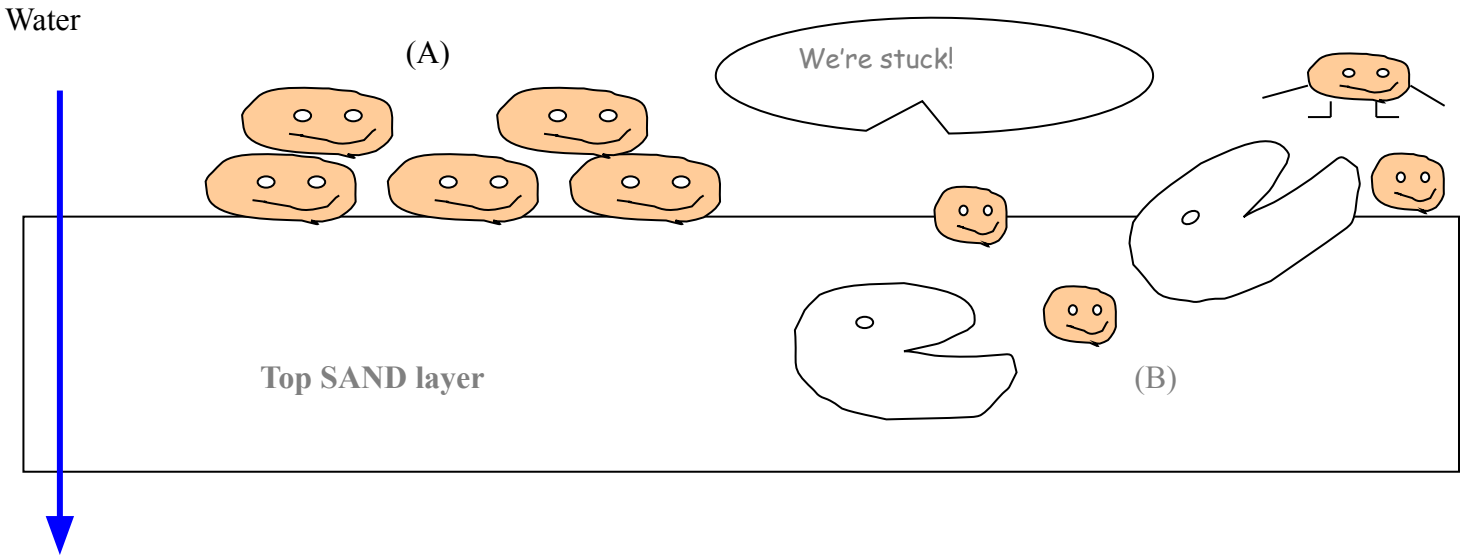

Arsenic Biosand Water Filter
KANCHAN FILTER
FINE SAND


MIT
U.S.A.
KANCHAN FILTER

Cross Section of ABF



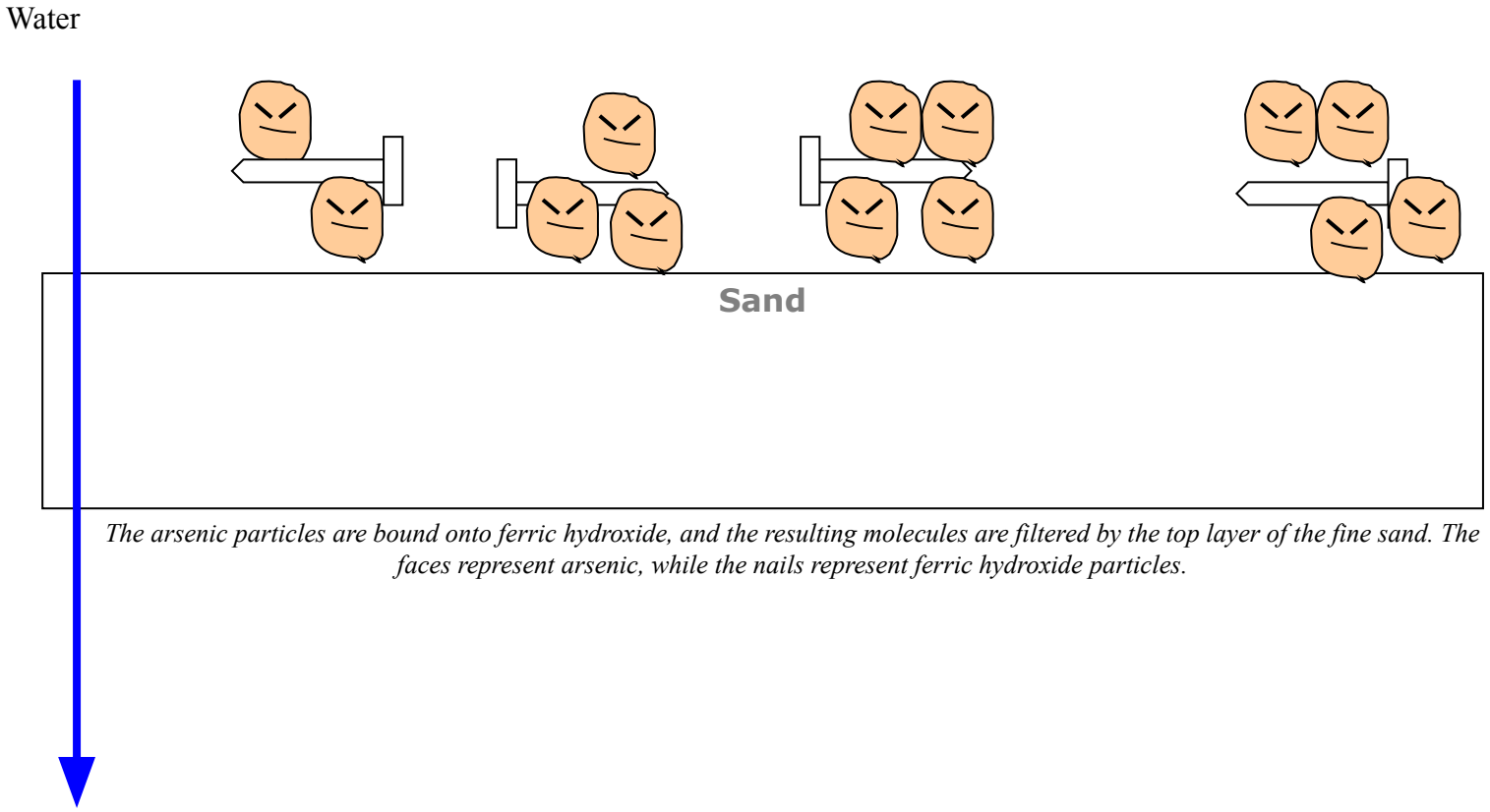
Pathogen & Arsenic Removal Mechanism



A : Physical Removal by surface straining – Bacteria are too large to pass through the sand layer

B : Biological removal by predation - The microorganisms living in the biofilm consume incoming bacteria.

Arsenic Removal Mechanism



The arsenic particles are bound onto ferric hydroxide, and the resulting molecules are filtered by the top layer of the fine sand. The faces represent arsenic, while the nails represent ferric hydroxide particles.

- **Ferric hydroxide (iron rust) is an excellent adsorbent for arsenic.**
- **Surface complexation reaction occurs when aqueous arsenic species come into contact with Fe $^{+++}$**

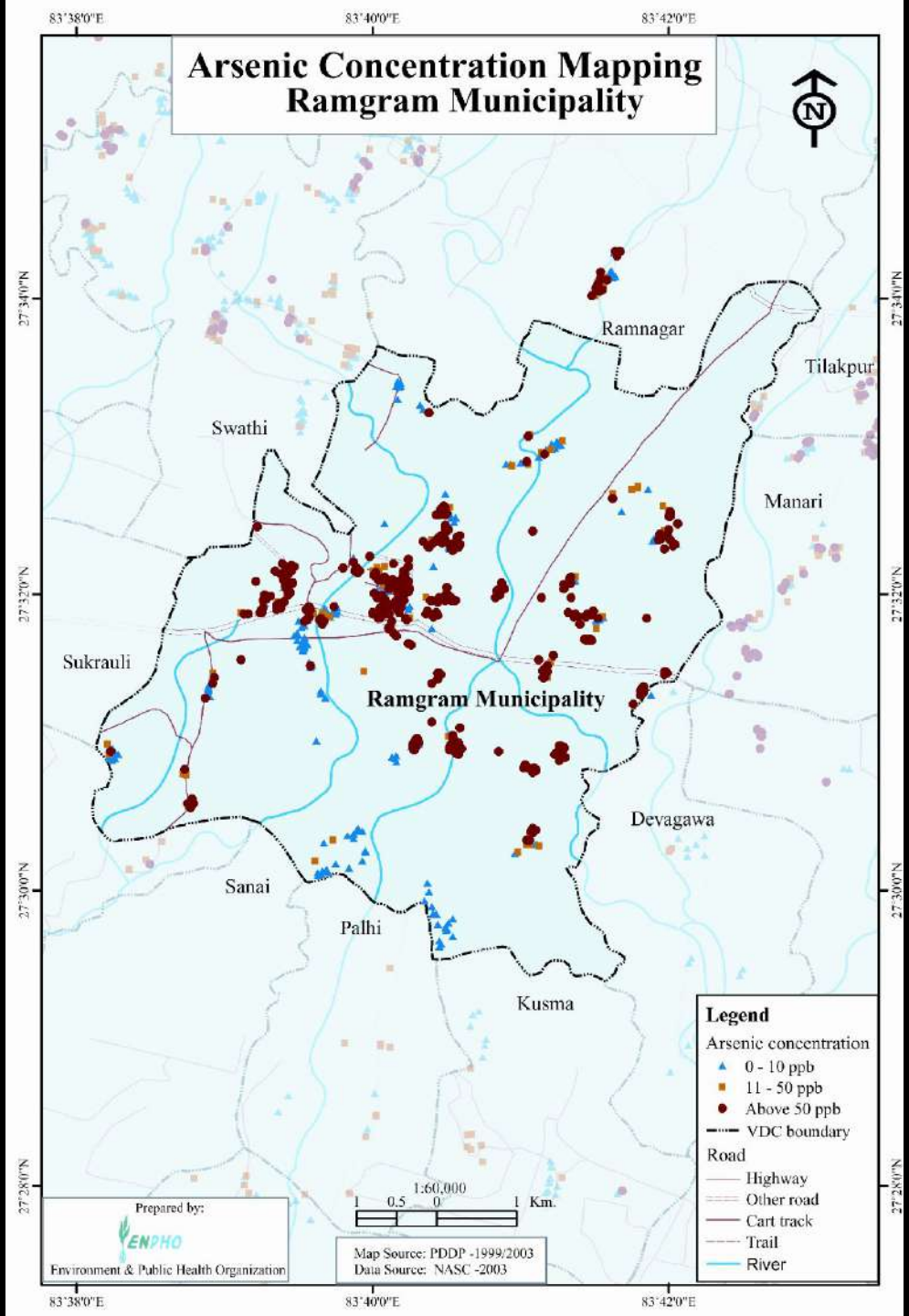
- Tested 1476 samples – ENPHO test kit & AAS
- Installation of community level arsenic bio sand filter as a pilot scale.
- Formulation of tubewell installation policy
- Training to technicians

DM 2003 Project Activities

- Established Kanchan Arsenic Filter Reference Center
- Trained and Established 10 local entrepreneurs at 11 arsenic affected districts – distributed about 1500 filters
- Monitoring and investigation
- Orientation workshop in 750 Wards of 150 VDCs

Future Program

- Conduct several trainings to district level health professionals
- Establish more local entrepreneurs
- Health Survey in other affected villages
- Awareness campaign
- Provide services for mitigation


Arsenic Concentration Mapping
Ramgram Municipality
N
83°38'0"E
83°40'0"E
83°42'0"E
27°34'0"N
27°32'0"N
27°30'0"N
27°28'0"N
Ramnagar
Tilakpur
Swathi
Manari
Sukrauli
Ramgram Municipality
Devagawa
Sanai
Palhi
Kusma
Legend
Arsenic concentration
0 - 10 ppb
11 - 50 ppb
Above 50 ppb
VDC boundary
Road
Highway
Other road
Cart track
Trail
River
1:60,000
1 0.5 0 1 Km.
Prepared by:
ENPHO
Environment & Public Health Organization
Map Source: PDDP -1999/2003
Data Source: NASC -2003

Back