

**WORLD BANK DEVELOPMENT MARKETPLACE – PROJECT 407  
ARSENIC BIOSAND FILTER PROJECT FOR RURAL NEPAL**

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**PROGRESS REPORT**

**31 MARCH 2004**

**Submitted to:**

**The World Bank  
Kathmandu, Nepal**

**Prepared by:**

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Programme (RWSSSP)  
Butwal, Nepal**

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## **Executive Summary**

The objective of this project is to promote the Arsenic Biosand Filter (ABF) as a sustainable and appropriate water treatment alternative in rural Terai. This project has been launched since January 2004. This project is on schedule despite the unstable political and security situation. All required outputs for Milestone 2 have been successfully achieved, including staff recruitment, office setup, equipment purchase, development of printed materials, field visit, filter monitoring, and networking. Several organizations have expressed interest in partnering with us to promote ABF in the Terai. The goals for the next two months include orientation workshops for local entrepreneurs, training of local VDC members and health post staff, educational workshop for villagers, as well as continued networking among interested parties with an aim to establish new partners to expand this project to new areas.

## **Project Description**

The “Arsenic Biosand Filter Project in Nepal”, led by Massachusetts Institute of Technology, is one of the winners at the World Bank Development Marketplace Competition 2003. The objective of this project is to promote the Arsenic Biosand Filter (ABF) as a sustainable and appropriate water treatment alternative in rural Terai. An award amount of US\$115,000 was granted by the World Bank to implement this project from February 2004 to October 2004.

Currently, many villagers in the rural Terai lack access to safe drinking water because of arsenic and pathogens contamination. To combat this problem, MIT, ENPHO and RWSSSP have developed an innovative household water filter for simultaneous arsenic and pathogen removal, using locally available materials, and constructed by local labor. The design is optimized based on the socio-economic conditions in rural Terai. Pilot studies have shown high user acceptance and excellent arsenic and pathogens removal. In addition, the filter can effectively remove iron, turbidity, and odor. The filter has a high flow rate sufficient for a large family.

The Development Marketplace funding will provide capital to promote ABF in Nepal. An in-country technology dissemination and implementation center is being setup. Local capacity will be built among the poor towards long-term, self-reliant, user-participatory safe water provision, involving training of local women, entrepreneurs, trainers, teachers, and authorities in 25 VDCs. Beside health benefits to the users, this project stimulates village development, and contributes to the World Bank’s country-specific goal of poverty-alleviation.

## **Work Accomplished to Date**

### **January 2004**

- Launched project
- Met our World Bank liaison, Shyam Ranjitkar, in Kathmandu to discuss project milestones and payment scheme.
- Began project planning, including preparation of detailed action plan activities, schedule, staff requirement, etc

## **February 2004**

- Finalized project milestone and payment scheme.
- Recruited 15 staff, including a project coordinator, two support officers, three researchers, two trainers, three health workers, two motivators, and two administrative staff.
- Conducted staff training in field work techniques on February 15-16, 2004.
- Developed monitoring protocols.
- Field workers started to visit and monitor installed ABF (about 800 in total) in eight districts including Kapilvastu, Rupandehi, Nawalparasi, Bara, Parsa, Rautahat, Siraha, and Saptari.
- Completed the setup and furnishing of Kathmandu ABF Center at ENPHO's office. Information about this project and/or ABF can be obtained from this office
- Completed the setup and furnishing of Butwal field office.
- Negotiated with Gintex Plastic Company on plastic filter mold manufacturing. No agreement was signed because of disagreements on terms and conditions.
- Identified local entrepreneurs such as local NGOs and community groups that are active in water and sanitation sector in their region.
- Met with artists to develop a number of IEC (information, education, communications) materials, including a general brochure on ABF, arsenic awareness and ABF O&M posters, animation clips on filter construction, project summary, etc.
- Met with Department of Water Supply and Sanitation (DWSS), UNICEF, National Arsenic Steering Committee (NASC), Nepal Red Cross Society (NRCS), Nepal Water for Health (NEWAH), Intermediate Technology Development Group (ITDG), and Fund Board to discuss this project.

## **March 2004**

- Finalized discussion with World Bank, MIT, and ENPHO on contract agreement.
- Purchased equipment necessary for effective project implementation, including computers, printers, video projectors, cameras, mobile phones, laboratory instruments, and bicycles.
- The purchase of the ABF mold is delayed because calculations showed that its high cost is not justified. Other options are being investigated.
- Field staff continued to monitor the performance and user acceptance of installed ABF.
- Project coordinators supervised field staff in their monitoring and data collection activities.
- Developed an ACCESS database to compile all ABF related data.
- Traveled to Butwal and Birgunj to visit local entrepreneurs, and to assess their capability and interest.
- The scheduled "Entrepreneurs Orientation" in Butwal was postponed due to unstable political and security situation during the recent Maoist strike
- Identified and assessed ABF construction materials, including sand and iron nails quality.
- Discussed with local materials suppliers and dealerships (e.g. Gem Plastic Birgunj, Butwal iron mold manufacturer) about distribution schemes and prices.
- Arranged Field Office at Nepal Red Cross Society (NRCS) building in Birgunj, Nepal
- Investigated an improved filter design for better performance at lower cost.
- Estimated market size of ABF in Terai.
- Segmented and categorized districts and VDCs based on market size, awareness level, income, ease of implementation, and funding sources.

- Evaluated users' willingness to pay, entrepreneurs business viability and subsidy required
- Explored and evaluated various distribution and supply chain schemes, promotion alternatives, subsidy and financing options.
- Met with NEWAH, International Development Enterprises (IDE), UNICEF, NRCS, Plan Nepal to discuss possible collaboration.
- Presented the ABF technology to a group of 25 engineers/ technicians at NEWAH in Kathmandu .
- Presented ABF information at “Decentralized Water & Wastewater Management -- Simple Techniques Workshop” in Kathmandu on March 14, 2004. Representatives from 29 municipalities (mostly mayors) from across the country are informed about the ABF technology.
- Presented ABF information at Royal Nepal Academy of Science and Technology Conference in Kathmandu on March 25, 2004.
- NRCS has agreed to be a partner in this project. They will assist us to conduct local entrepreneur trainings, VDC-level orientations and village/ward level public education and awareness activities.
- NEWAH are interested in providing the filter in Kailali District.

### **Milestone #2 US\$46,000 (40% of total fund)**

Deadline March 31, 2004.

Required Output March 31, 2004	Accomplishment as of March 31, 2004	Successfully Completed?
Recruit and orient staff	<ul style="list-style-type: none"> <li>• Successfully recruited 15 staff</li> <li>• Conducted staff orientation</li> </ul>	YES
Establish ABF centers (at Kathmandu and Districts)	<ul style="list-style-type: none"> <li>• Setup three ABF offices (Kathmandu, Butwal, Birgunj)</li> <li>• Information about the ABF can be obtained from the Kathmandu office</li> </ul>	YES
Purchase major equipments (ABF molds, audio-visual equipments, computers, printers, cameras, mobile phones etc)	<ul style="list-style-type: none"> <li>• Purchased all necessary major equipment for project implementation</li> <li>• The purchase of an ABF mold is delayed because it is not cost effective from the intended manufacturer. Other options are being investigated.</li> </ul>	YES
Develop construction manual, O&M manual, posters, documentary	<ul style="list-style-type: none"> <li>• Developed a number of IEC (information, education, communications) materials, including brochures and posters</li> </ul>	YES
Visit and monitor installed ABF in 8 districts, select and test of ABF materials (sand, iron nails, etc)	<ul style="list-style-type: none"> <li>• Started to visit and monitor installed ABF in 8 districts.</li> <li>• Collected and assessed ABF construction materials in Terai, including sand quality and iron nails quality.</li> <li>• Discussed with local materials suppliers and dealers (e.g. Gintex, Gem Plastic) about distribution schemes and prices.</li> </ul>	YES

Identify and negotiate with local entrepreneurs in 11 districts	<ul style="list-style-type: none"> <li>• Identified and communicated with 30 local entrepreneurs from 11 districts.</li> <li>• Responses from these entrepreneurs have been positive.</li> <li>• local entrepreneurs training workshop (15 participants), planned for March, has been postponed to April.</li> </ul>	YES
Network with water supply implementers	<ul style="list-style-type: none"> <li>• Discussed with UNICEF, Nepal Red Cross Society, ITDG, NEWAH, Plan Nepal, etc about the ABF project and potential for collaboration.</li> <li>• NRCS and NEWAH expressed interest to distribute ABF in their operating regions.</li> </ul>	YES
Submit a progress report of activities carried out during this period to the Project Liaison	<ul style="list-style-type: none"> <li>• This is the progress report</li> </ul>	YES

## Budget

Due to unexpected administrative issues between World Bank, MIT, and ENPHO, there has been a delay in signing the Final Contract. Thus, the first payment of \$23,000 (due date January 31, 2004) has not been released yet. Currently, both MIT and ENPHO have to acquire/borrow funds from other accounts to pay for the activities in this project.

## Problems

The current unstable political and security situation in Nepal caused unexpected delays and inconvenience in our work. Several times, scheduled meetings and training workshops were cancelled because of the general strike (*bandha*). Field work progress has also been slowed due to the difficulties in traveling to field sites, especially those in the western districts. As a result, the project focus has shifted to concentrate our efforts in the Central and Eastern districts where there is less tension between the Maoists and the government

## Future Steps

The next milestone deadline is on May 31, 2004. Within this period, entrepreneurs training, VDC-level orientation, and village/ward level awareness workshop will be conducted. Nepal Red Cross Society and/or other relevant authorities will assist this project of filter distribution and provide some subsidies to promote the ABF technology. Networking with water supply implementers will be continued in order to establish new partnership to expand this project to new areas. In addition, monitoring of the installed ABF will be completed. The next progress report will be submitted on May 31, 2004.

## Appendix A – Human Resources List

	<b>Personnel</b>	<b>Agency</b>	<b>Responsibilities</b>
1	Susan Murcott, Principal Investigator	MIT	Supervision, communications between MIT, World Bank, ENPHO, RWSSSP, information dissemination in MIT and internationally
2	Tommy Ngai, Researcher	MIT	Communications with MIT, World Bank, ENPHO, RWSSSP, Conduct research, Prepare monitoring and evaluation plan
3	Roshan Raj Shrestha, Coordinator/ technical resource person	ENPHO	Coordination with MIT, World Bank, stakeholders, project team & provide technical support
4	Jeebendra Ghimire, Program support officer	ENPHO	Support to conduct all activities at district level, Provide guidance to field staff, develop health survey, Organize training workshops
5	Bipin Dongol, Researcher	ENPHO	Carryout scientific research in coordination with MIT researcher
6	Juna Shrestha, Researcher	ENPHO	Data compilation at field level, Support in research activities
7	Binod Dahal, Trainer	ENPHO	Conduct awareness and training programs at field level
8	Hari Budathoki, Supervisor/ Motivator	ENPHO	Motivation and data collection at community level, Conduct training programs
9	Rajendra Mahato, Health Worker	ENPHO	Motivation, data collection, and health survey at community level
10	Gauri Budathoki, Health Worker	ENPHO	Motivation, data collection, and health survey at community level
11	Palpasa Tuladhar, Documentation Officer	ENPHO	Contact person for ABF center, data compilation, information management etc.
12	Sunita/Devendra, Administrator/Accountant	ENPHO	Keep track of all administrative duties and accounts
13	Kalawati Pokharel, Program Support Officer	RWSSSP	Support to conduct all activities at district level, Provide guidance to field staff, Develop health survey, Organize training workshops
14	Umesh Sharma, Part-time Trainer	RWSSSP	Conduct awareness and training program at field level
15	Bhim Parajuli, Part-time Health Worker	RWSSSP	Motivation, data collection, and health survey at community level
16	Balram Khanal, Motivator	RWSSSP	Motivation, data collection, and health survey at community level

## Appendix B – Summary of Activity Schedule

S.N	Activities	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
<b>1</b>	<b>Project Preparation</b>											
1.1	Preparation of detail activities and budget breakdown	4										
1.2	Setup management committee	4										
1.3	Project agreement with WB	4	1									
1.4	Identification of human resources	4										
1.5	Preparation of project implementation guideline	4	1									
1.6	Setup ABF center and site offices	4	1234									
1.7	Staff selection & recruitment		1234									
1.8	Procurement of logistics	4	1234									
1.9	Preparation of IEC materials		1234									
1.10	Database development (software)		12									
1.11	Preparation of TOR for all project team members	4	1									
<b>2</b>	<b>Identification of Container Manufacturers</b>											
2.1	Negotiation with manufacturers		12									
2.2	Mold fabrication for plastic ABF			34								
2.3	Mold (metal) fabrication for concrete ABF		3									
<b>3</b>	<b>Identification of Local Entrepreneurs</b>											
3.1	Collection of local entrepreneurs list		4	123								
3.2	Negotiation with local entrepreneurs		12									
3.3	Training & orientation to local entrepreneurs				34							
<b>4</b>	<b>Identification of Sand Source in District Level</b>		4	12								
<b>5</b>	<b>Orientation to Water Supply Implementers</b>				34							
<b>6</b>	<b>Model VDCs</b>											
6.1	Selection of model VDCs		12									
6.2	Site visit		4	1234								
6.3	Collection of information from the selected sites				1234							
6.4	Develop detail plan for model VDCs				4							
6.5	Orientation training/awareness campaign					1234	1234	1234	1234			
6.6	Health survey				34	1234			34	12		
<b>7</b>	<b>Monitoring of ABF</b>											
7.1	Collection of information about installed ABF		4	1234	12							
7.2	Testing of ABF		4	1234	12				34	1234		
<b>8</b>	<b>Review Meetings with all Stakeholders, Supervision and Monitoring</b>					34	1234	1234	1234	1234		
<b>9</b>	<b>Scheduled Meetings</b>											
9.1	Management committee meeting		2	1	1	1	1	1	1	1		
9.2	Staff meeting		4			4			4			
<b>10</b>	<b>Seminars and Conferences</b>											
10.1	National workshop at Kathmandu										4	1
10.2	Seminar at MIT											4
<b>11</b>	<b>Reporting</b>											
11.1	Progress report to WB			4		4					4	
11.2	Semi-final report									12		
11.3	Project completion report submitted to WB											4



## Appendix C – Information and Educational Materials

### Arsenic Biosand Filter General Brochure (English version, Front page)

**Construction Materials Required:**

- Plastic or Concrete filter casing
- PVC pipes and fittings
- Gravel
- Coarse sand
- Fine sand
- Iron nails
- Brick chips
- Plastic or metal diffuser basin

**For More Information, Contact:**

**ABF Project/ ABF Reference Center**

**Cross section of the filter**

**In partnership with:**

**Environment and Public Health Organization (ENPHO)**  
Thapagaon,  
New Baneshwor, Kathmandu, Nepal.  
P.O. Box 4102  
Tel: +977-1-4468641, 4493188  
Email: enpho@mail.com.np  
Website: www.enpho.org

Massachusetts Institute of Technology (MIT), USA

Rural Water Supply and Sanitation Support Programme (RWSSSP)  
Butwal

**Arsenic Biosand Filter  
(Kanchan Filter)**

Removal of Drinking Water Contaminants including Arsenic, Bacteria, Iron, Turbidity, and Odour

**Environment & Public Health Organization (ENPHO)**  
Kathmandu  
**Massachusetts Institute of Technology (MIT)**  
USA  
**Rural Water Supply and Sanitation Support Programme (RWSSSP)**  
Butwal

March – 2004

# Arsenic Biosand Filter General Brochure (English version, Back page)

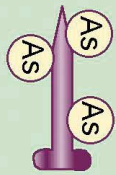
## What Are The Problems/ Issues?

Many people in the rural Terai region of Nepal lack access to safe drinking water. Tube well drinking water sources from a number of districts are contaminated with arsenic. In addition, many of these sources have found to contain fecal bacteria contamination. Currently, an appropriate and satisfactory solution has yet to be found. Therefore, many villagers continue to drink contaminated water, and may suffer from preventable water-borne diseases including diarrhea, stunting, skin lesions and cancer.

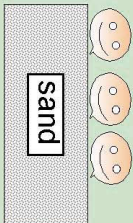
## Our Solution – Arsenic Biosand Filter (Kanchan Filter)

MIT, ENPHO and RWSSSP have developed an innovative household water filter for simultaneous arsenic and pathogen removal, using locally available materials, and constructed by local labour. The two design versions (plastic and concrete) are optimized based on the socio-economic conditions in rural Terai. Pilot study shows high user acceptance and excellent arsenic and pathogens removal. In addition, the filter can effectively remove iron, turbidity, odour and have a high flow rate sufficient for a large family. The World Bank Development Marketplace Competition 2003 has awarded for the promotion of this filter in Nepal.

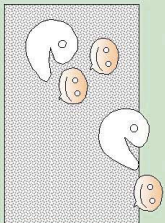
## Contaminants Removal Mechanism:



Arsenic (As) particles are effectively adsorbed on the rusted iron nails surface.



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.

## Simple Operation Procedures:

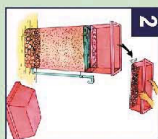


1. Pour water to the top basin. Water will pass through filter and up the pipe.
2. Collect treated water from the pipe outlet.
3. If the flow rate is insufficient, then maintenance is required.

## Simple Maintenance Procedures:



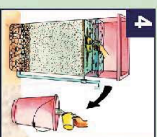
Wash your hands with soap.



Remove top basin.



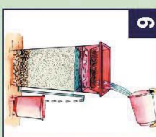
Stir the uppermost 1/2 inch of sand with your fingers.



Remove turbid water with a cup. Replace the basin and add more water. Repeat the stirring process for two additional times.



Discard the turbid water into a dung hole with some cow dung in it.

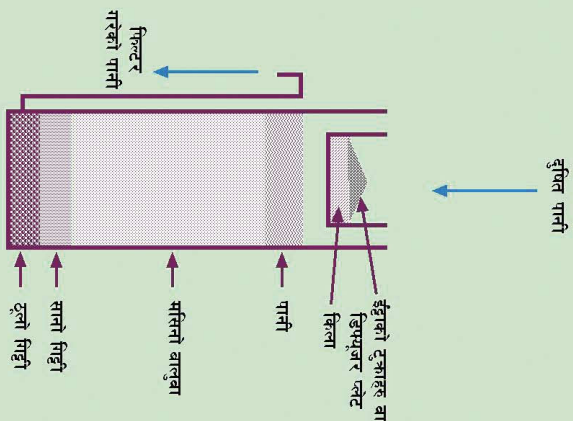


Now the filter can be used again.

# Arsenic Biosand Filter General Brochure (Nepali version, Front page)

## फिल्टरलाई चाहिने सामग्रीहरू :

- एनाडिक वा कक्रिटको गोडो
- पि.भि.भि. पाइप र फिटिङहरू
- टाट्टी (सानो र ठूलो)
- जारिजो बालुवा
- किला
- केही ईट्टाका टुकुराहरू वा डिप्युजर प्लेट
- एनाडिकका बाटा वा घाबुको बाकस ।



## थप जानकारीको लागि :

कञ्चन फिल्टर सूचना केन्द्र



## वातावरण र जनस्वास्थ्य संस्था (एनफो)

श्यापाडाँ, नयाँ बानेश्वर, काठमाडौं, नेपाल  
 फो.ब. नं. : ४१०२  
 फोन नं. : ९७७-१-४४६६६९, ४४९३१८८  
 फ्याक्स : ९७७-१-४४९१३७६  
 ईमेल : [enpho@mail.com.np](mailto:enpho@mail.com.np)  
 वेबसाईट : [www.enpho.org](http://www.enpho.org)

## सहकार्य गर्ने संस्थाहरू :



न्यासायूसेट इन्स्टिट्यूट आफ टेक्नोलोजि



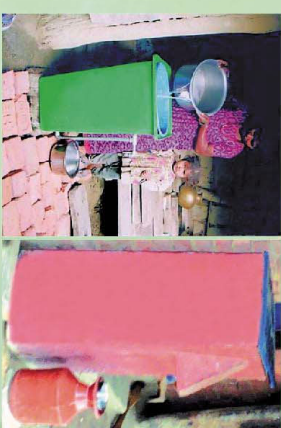
शांतिगण स्थानोपानी तथा सरसफाई सहयोग कार्यक्रम



नेपाल रेडक्रस सोसाइटी  
काठमाडौं

## कञ्चन फिल्टर

पानीबाट आर्सेनिक, जीवाणु, आइरन र धातिलोपना हटाउने घरेलु प्रविधि



वातावरण र जनस्वास्थ्य संस्था (एनफो)

काठमाडौं

न्यासायूसेट इन्स्टिट्यूट आफ टेक्नोलोजि

शांतिगण स्थानोपानी तथा सरसफाई सहयोग कार्यक्रम  
 बुटवल

२०६०



**संक्षेपः**

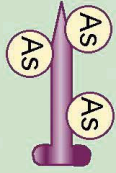
नेपालको ग्रामीण तराई क्षेत्रमा बसोबास गर्ने धुपै बासिन्दाहरू अहम पनि सुरक्षित सानोपानीबाट बाहिर हुन । यस क्षेत्रको सानोपानीको मुख्य स्रोत नै दूधढोला नै । हालसालैको अध्ययन अनुसार तराईका धुपै-बासिन्दाको दूधढोलको पानीमा अत्यधिक मात्रामा आर्सेनिक तत्व पाइएको छ । यसको साथ साथै सरसफाईको कमीले गर्दा पिउने पानीमा रोगा जन्य जीवाणुको पनि प्रदूषण हुने गरेको पाइएको छ । जसको फलस्वरूप यस क्षेत्रका बासिन्दाहरू विभिन्न पानीजन्य रोगजन्यबाट संक्रमित हुने सम्भावना रहेको छ भने आर्सेनिक युक्त पानीको सेवनले गर्दा क्यान्सर जस्ता विभिन्न रोगबाट उनीहरू प्रभावित हुन सक्ने देखिन्छ ।

**समाधानः**

**कठचन फिल्टर (आर्सेनिक बायोस्पाण्ड फिल्टर)**

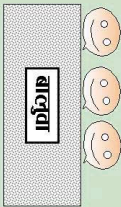
अमेरिकास्थित क्याम्ब्रिजसहित इन्टरन्याट अफ टेक्नोलोजी, ब्राउनशा र जलस्वच्छता संस्था र ग्रामीण सानोपानी तथा सरसफाई संस्थाका कालेजको संयुक्त प्रयासले पानीबाट आर्सेनिक र जीवाणु दुवै हटाउन सक्ने एउटा सरल वस्तु पवित्रिको विकास गरेको छ । यो एक सुधारिएको बायोस्पाण्ड फिल्टर नै जसलाई कठचनफिल्टर नामाकरण गरिएको छ । यो फिल्टरलाई ट्याङ्किङ वा कन्क्रिटको बर्तनमा बनाइन्छ जसमा स्थानियवस्तीको पाइने सानाटापिस् (टिप्टी, बालुवा र किल्ला) राखिएको हुन्छ । दुई वर्षको अवधयन, अनुसन्धान अनुसार यस फिल्टरबाट खानेपान र पिउने पानीमा आर्सेनिक ९५% भन्दा बढी घटवुको साथै पानीमा रहेको आइरन र योनिपानी पनि ९९% घटन गएको पाइएको छ । यसरी खानेपान आएको पानी जीवाणु रहित हुनको साथै पानीको स्वादलाई पनि राम्रो पार्दछ । यस फिल्टरबाट प्रतिघण्टा ३० लिटर पानी खान सक्ने क्षमता भएको कारणले गर्दा ठूलो परिवार संस्था भएको घरलाई पनि पवित्रिको पानीको सहायताले गर्दा नै यस पवित्रिको प्रथमलगाती विश्व बैकद्वारा संचालित खेतोपानीबाट आर्सेनिक घटाउन २००७ वा पुरस्कृत गरिएको छ ।

**आर्सेनिक हट्ने प्रक्रिया :**

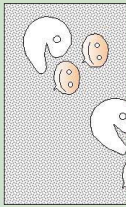


आर्सेनिक युक्त पानी फिल्टरमा सन्धाईदा फिल्टरको माथिलगाती माथामा रहेको रिखा लागेको किल्लामा आर्सेनिक तत्व लीसिन जाई पानीबाट आर्सेनिक हट्न पुग्दछ ।

**जीवाणु हट्ने प्रक्रिया :**



यस फिल्टरमा रहेको मासिन बाढुवाका कणहरूबाट केही प्रकारका ठूला जीवाणुहरू आलिन्छन् ।



अन्त्य स-साना जीवाणुहरूलाई बाढुवाको माथिलगाती सतहमा हुने अतिक्रमणको कारणले नाल हुन पुग्दछ ।

बाढुवाको सतहमा तैरिने पक्रिया थालनी हुन तीन हप्ता लाग्ने भएकाले कारणले गर्दा यस फिल्टरले सो सतह अवधिसतहमा सतरी जीवाणु नष्टाउन पनि सक्दछ ।

**फिल्टर प्रयोग गर्ने विधि :**

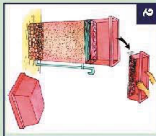


1. पानीलाई फिल्टरको माथिलगाती भागमा सतथाउने ।
2. उक्त पानी फिल्टर भएर पाइदाबाट निस्कन्छ जुन पानी पिउनको लागी खाद्य हुन्छ ।
3. यदि फिल्टरबाट पानी कमा जात्रामा (साना पकाउन र पिउन नपुग्ने जसरी) कर्तमाथिलगाती फिल्टर सफा गर्ने बेला भएकाले कुनैपनि पार्दछ ।

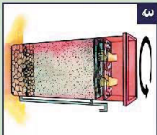
**फिल्टर सफा गर्ने विधि :**



साइल पानीले सत सतमा पुग्ने ।

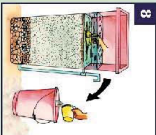


किल्ला सतसेको र बाहिर निकालने ।



बाढुवाको माथिलगाती सतहबाट आधा इन्च जाति किन सतह सत रिखाएर राम्रो सजा बाढुवालाई घालाउने ।

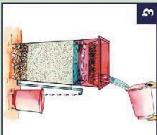
एक दिन पलापुछि बाढुवामाथिको पक्रिय पानी सफा सजाले बाहिर बाहिरलगाती निकालने । पुनः र सतह पानी सतथाई दुई पटक सतह यसरी नै सफा गर्ने ।



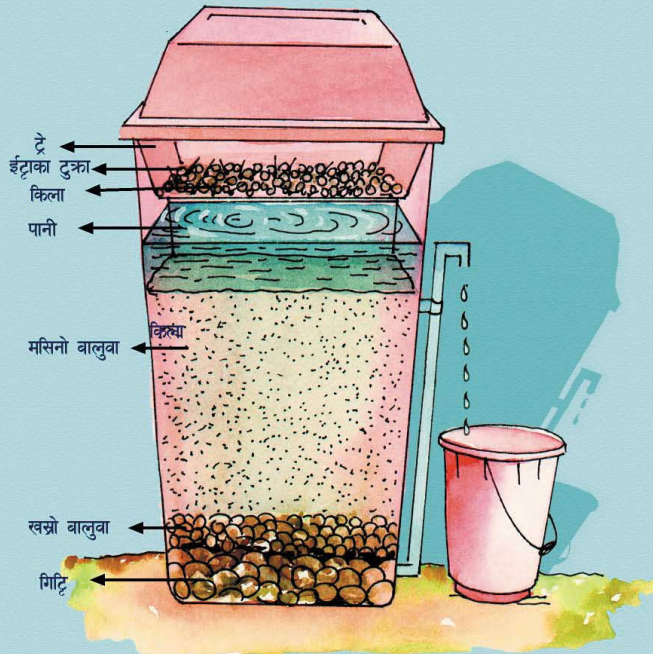
सफा गर्दा निस्कको फोहोर पानीलाई जोरसतमा फ्यालने ।



किल्ला सतसेको रैलाई पहिले जसरी जसरी फिल्टरमा किल्लापर राख्ने । त्यसपछि पानी सतथाई फिल्टर प्रयोगा गर्ने सतकिन्छ ।



# कञ्चन फिल्टर



## यस फिल्टरका विशेषताहरू

- ◆ आर्सेनिकको साथसाथै आइरन पनि हट्ने ।
- ◆ पानीमा भएको अनावश्यक गन्ध, घामिलोपना हट्ने ।
- ◆ सुक्ष्म जिवानु पनि हटाउने ।
- ◆ प्रयोग गर्न तथा मर्मत सम्भार गर्न सजिलो ।
- ◆ पर्याप्त मात्रामा पानी फिल्टर हुने ।

## फिल्टर प्रयोग गर्ने विधि

- ◆ पानीलाई फिल्टरको माथिल्लो भागमा सन्याउने ।
- ◆ उक्त पानी फिल्टर भएर पाइपबाट निस्कन्छ जुन पानी पिउनको लागि योग्य हुन्छ ।

## ध्यान दिनु पर्ने कुराहरू

- ◆ फिल्टरलाई जहिले पनि ढक्कनले छोपी राख्नु पर्दछ ।
- ◆ पानी सन्याउँदा किलाको सतह नबिग्रने गरी सन्याउनु पर्दछ ।
- ◆ फिल्टरमा टे नराखिकन कहिल्यै पनि पानी सन्याउनु हुँदैन ।
- ◆ फिल्टर बाट पानी कम मात्रामा (साना पकाउन र पिउन नपुग्ने गरी) कर्न थालेमा फिल्टर सफा गर्ने बेला भएको बुझ्नु पर्दछ ।
- ◆ बालुवाको सतह माथि सधैं पानी रहिरहनु पर्दछ ।
- ◆ फिल्टरलाई जहिले पनि सुरक्षित र सफा ठाउँमा राख्नु पर्दछ ।

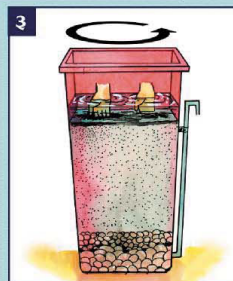
## फिल्टर सफा गर्ने विधि



साबुन पानीले हात राम्रो सँग धुने ।



किला राखेको ढे बाहिर निकाल्ने ।



बालुवाको माथिल्लो सतह बाट आधा इन्च जति मित्र सतह हात छिराएर राम्रो सँग बालुवालाई चलाउने ।

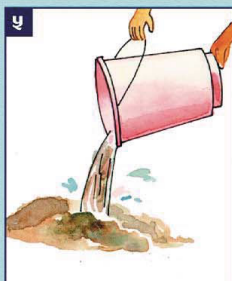


एक छिन चलाएपछि बालुवामाथिको फोहर पानी सफा मगले बाहिर बालिठनमा निकाल्ने । पुनः टे राखेर पानी सन्याई दुई पटक सतह यसरी नै सफा गर्ने ।

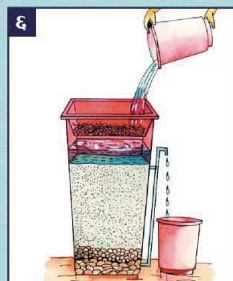
## थप जानकारीको लागि



वातावरण र जनस्वास्थ्य संस्था (एनफो)  
११०/२५ आर्दश मार्ग-१  
थापागार्ज, नयाँ बानेश्वर  
पो.ब.नं. : ४१०२, काठमाडौं (पूर्व), नेपाल  
फोन : ९७७-१-४४६६६४१, ४४९३१८८  
फ्याक्स : ९७७-१-४४९१३७६  
E-mail: enpho@mail.com.np  
URL: www.enpho.org



सफा गर्दा निस्केको फोहर पानीलाई गोबरमा फ्याल्ने ।



किला राखेको देलाई पहिले जस्तै गरी फिल्टरमा मिलाएर राख्ने । त्यसपछि पानी सन्याई फिल्टर प्रयोग गर्न सकिन्छ ।

## Appendix D – Monitoring Form

### Field Monitoring Form (English version, Page 1)

Sampling Date and Time	
Your Name	
District	
VDC	
Ward No.	
Tole	

#### ARSENIC BIOSAND FILTER INFORMATION

User's Name	
ABF ID (to be determined in office)	
Photo Number	
GPS location	Accuracy: Elevation: X-coordinate: Y-coordinate:
Type of ABF	(1) Concrete, round (3) Plastic, round (2) Concrete square (4) Plastic, square
ABF Provided by	(1) NRCS (4) Others, specify: (2) RWSSSP (3) RWSSFDB
ABF Installation Date	
Source of Sand	(1) River (4) Others, specify: (2) Crushed (3) Don't know, supplied by installation agency
Source of Iron Nails	
Quantity of Iron Nails (kg)	
Number of Households	
Number of ABF Users	
Filter Currently in Use?	(1) Yes, everyday (3) No, explain why: (2) Yes, sometimes
Use of Water (check all that applies)	(1) Drinking (4) Others, specify: (2) Cooking (3) Washing
User's Contributions Towards this ABF (check all that applies)	(1) Labour, specify: (2) Cash, how much: (3) Materials, specify: (4) Others, specify:
Sanitary Conditions Around ABF	(1) Clean (3) Poor (2) Moderate (4) Very dirty
Source of Drinking Water	(1) Tube Well (4) Others, specify: (2) Dug Well (3) Spring
Sludge Disposal Location	(1) Cow Dung (4) Anywhere (2) Ditch (5) Others, specify: (3) Field
Owner's household has an arsenic patient? (take picture if yes)	(1) Yes, name: (2) No
Owner knows somebody (non-household member) who is an arsenic patient?	(1) Yes (2) No
When away from home, what do the users drink?	(1) ABF filtered water from home (4) Others, specify: (2) Safe tube wells (3) Any available water source

## Field Monitoring Form (English version, Page 2)

Filter Cleaning Frequency	(1) once every week (2) once every two weeks (3) once a month	(4) once every 2-4 months (5) never
Date of Last Cleaning		

### FIELD MONITORING RESULTS

#### pH

Influent	Effluent	Test Method/ Instrument	Remarks

#### Flow rate

Time to Fill 100mL Bottle (seconds)	Water Level in Diffuser Box (select one:)	Remarks
	Full, 3/4, 1/2, 1/4, Empty	

#### Arsenic

Influent (ug/L)	Effluent (ug/L)	Test Method/ Instrument	Remarks

#### Iron

Influent (mg/L)	Effluent (mg/L)	Test Method/ Instrument	Remarks

#### Phosphorus

Influent (mg/L)	Effluent (mg/L)	Test Method/ Instrument	Remarks

### TUBE WELL INFORMATION

Tube Well Contact Person		
Tube Well Number		
Tube Well Provided by	(1) NRCS (2) RWSSSP (3) DWSS (4) NEWAH (5) RWSSFDB	(6) PLAN Nepal (7) Private (8) Others, specify:

### USER'S COMMENTS

Comments Category	(1) filter installation and O&M issues (2) water quality issues (3) health and hygiene issues (4) others
Detail Comments	

### YOUR OBSERVATIONS AND COMMENTS

--



## Appendix E – Training Manuals

### Guidelines on Local Entrepreneurs Training

#### **Introduction:**

In the Terai region of Nepal, shallow tube wells represent the main drinking water sources for most people. The water from the tube wells were considered to be safer than the water from dug well and ponds, and were believed to contribute to the reduction of water-borne diseases. In addition, the installation and running cost is generally affordable by communities. Therefore, tube well was an attractive and popular drinking water option, from both water supply implementers' and users' point of view. As a result, about 500,000 tube wells have been installed throughout the Terai, of which about 80% are private and remaining are public. Recently, the detection of arsenic contamination in ground water has raised serious health concern in Nepal. Arsenic is a poison. Long-term consumption of arsenic contaminated water can cause skin diseases and cancer in various human organs. According to national data, approximately 8% of all tube wells in the Terai are found to contain arsenic concentration above 50 ppb, which is the Nepal Interim Standard. There is no appropriate remedy for arsenic-affected patients besides the discontinuation of drinking arsenic contaminated water. Therefore, the consumption of arsenic-free water can help to prevent arsenic-related health concerns for Terai villagers.

To this end, MIT, ENPHO, and RWSSSP have developed a household-level arsenic removal filter after intensive research for 3 years. This Arsenic Biosand Filter (ABF), which is called Kanchan filter in Nepali, is an improve version of Biosand Filter initially developed by a Canadian scientist Dr. David Manz. Currently about 1000 Kanchan filters have been provided to arsenic affected communities by RWSSSP, NRCS, and RWSSFDB with the technical support of ENPHO. However, most people in arsenic affected areas still lack access to this filter. One reason is that only national-level organizations are involved in filter distribution in their operating regions. This raised the issue about how to make the filter easily accessible for most people. There is also the concern about the lack of proper training of the current users about filter operation and maintenance provided by these filter-providing agencies. To fill this information and accessibility gap, the concept of local entrepreneurs was developed. Local NGOs, CBOs and local technicians can act as local entrepreneurs. The local entrepreneurs can play a key role to prepare and supply filters to users. The entrepreneurs will be responsible to control filter quality. The entrepreneurs will also conduct the activities among arsenic-affected community to raise public awareness on arsenic, and to monitor the supplied filters.

Therefore, an orientation program for local entrepreneurs is necessary. This program is organized under the Arsenic Biosand Filter Promotion Program.

#### **Objectives:**

##### *Long term objectives*

- To provide arsenic free/ potable water to those people who are at the risk of arsenic so that arsenicosis can be prevented.
- To develop a local lead agency to supply arsenic removal filters.
- To strengthening the capacity of local NGOs and CBOs for arsenic mitigation.



### *Immediate objectives*

- To develop a sustainable mechanism to supply filters at the local level
- To orient the participants about the arsenic problem and different types of household filter
- To train the participants to properly assemble filters

### **Expected Outcome:**

- After this training participants will be able to understand about the arsenic problem and its effect in peoples' health.
- Participants will be able to assemble the Kanchan filter
- Mechanism for the filter distribution will be developed
- One demo ABF unit will be setup at the office of each entrepreneur
- Construction, promotion, and selling of filter will begin

**Duration:** 2 days

### **Participants:**

- 30 participants in each orientation (including representative of local NGOs, CBOs and local technicians in arsenic-affected areas)

### **Facilitators:**

- Engineer 1
- Water Quality Expert 1
- Health & Sanitation Expert 1
- Chemist 1

### **Materials Required:**

- This training manual 1
- List of local entrepreneurs and addresses 1
- Gem 505 plastic bucket 25
- Gem 1700 plastic basin 25
- Gravel 30 L
- Coarse sand 30 L
- Fine sand 150 L
- Piyush 50 bottles
- Iron nails 125 kg
- One liter measuring cup (Gem 016) 25
- Pipe, fittings, Teflon tape, etc. 25 sets
- Tools 25 sets
- ABF Posters (3 per participant) 90 plus some extra
- NASC Poster (3 per participant) 90 plus some extra
- ABF Brochure (10 per participant) 300 plus some extra
- ABF Sticker poster (10 per participant) 300 plus some extra
- My Clear Bag 30
- Notebook 30
- Dot-pen 30
- Certificates for participant 30
- Meta card some
- Food 40 people

**Activities:***Pre-training activities (1 week before actual training day)*

- Confirm training location, date, and time
- Inform participants about training location, date, and time
- Purchase and transport all necessary materials (e.g. sand, buckets, tools) to training location

*Schedule /Content of Orientation*

1st Day			
Time	Contents	Teaching/Learning Activities	Person in charge
9:00-10:00	Registration of Participants	Self	Hari
	Breakfast		Hari
	Participants' expectation collection	Meta card	Hari
10:00-10:15	Introduction to DM program and training objective	Lecture	Kala
10:15-11:15	NGOs sharing experience in water supply	Discussions	Binod
11:15-11:45	Water quality and its importance	Explanation, discussion, demonstration	Binod
11:45-12:00	Tea Break		Hari
12:00-12:45	Arsenic contamination in drinking water, situation of arsenic in Nepal and its health affects	Explanation using IEC materials	Roshan
12:45-13:15	Arsenic removal techniques	Explanation/ Discussions	Roshan
13:15-14:15	Lunch Break		Hari
14:15-14:30	Participants' experience on ABF	Meta card	Binod
14:30-15:30	Introduction to ABF, types of ABF Efficiency of ABF regarding physical, chemical and biological parameters	Explanation and discussions	Tommy and Bipin
15:30-16:30	Construction and Installation process of filters	Explanation by using drawing	Tommy and Bipin
16:30-16:45	Tea Break		Hari
16:45-17:30	Concept of Local entrepreneurs and its importance	Presentation	Roshan
17:30-18:00	Questions		Binod
18:00-18:30	Rest		Hari
18:30-19:30	Dinner		Hari

2nd Day			
8:00-8:30	Breakfast		Hari
8:30-9:00	Review of previous day	Ask participants to explain lessons learned	Binod
9:00-11:00	Demo filter installation	Practical	Tommy

		Each participant will construct a filter	and Bipin
11:00-12:00	Lunch		Hari
12:00-14:30	Discussion on how to obtain filter materials, promote and distribute filters, make profit, keep business sustainable, deal with donors, government and general public	Group discussions	Roshan, Kala, Binod, Tommy, Bipin
14:30-15:00	Commitments from local entrepreneurs		Binod
15:00-15:30	Certificate distribution and closing		Red Cross
15:30-17:00	Questions	Optional	Binod

*Post-training activities*

- Each of the entrepreneurs will setup one demo ABF in their office
- Visit each of the entrepreneurs to observe their progress on filter construction, promotion, and selling
- Provide follow up training if necessary
- Provide additional IEC materials if necessary

**Budget:**

<i>Item</i>	<i>Units</i>	<i>Rate (NRs)</i>	<i>Total (NRs)</i>
Per diem allowance for participants (2 ½ days)	30	625	18,750
Transportation for participants (return bus ticket)	30	350	10,500
Lodging (2 nights)	40	200	8,000
Hall Rental	n/a	1,500	1,500
Demo ABF	25	1,300	32,500
Tools	25	1,000	25,000
Stationaries	30	50	1,500
ABF Poster	100	25	2,500
ABF Brochure	300	10	3,000
ABF Sticker poster	300	20	6,000
NASC Poster	300	free	0
Certificates	40	50	2,000
Lunches (2 meals)	40	160	6,400
Dinners (3 meals)	40	240	9,600
Refreshment	40	100	4,000
Others	n/a	3,750	3,750
Total Expense			135,000
Expense per participant			4,500

## **Guidelines on VDC-Level Orientation**

### **Objectives:**

- To increase the awareness among VDC members, health post, teachers about water related diseases, health, hygiene, and sanitation
- To inform about various treatment options for arsenic and bacteria removal
- To demonstrate the installation, operation, and maintenance of ABF
- To orient on how to obtain a filter (local entrepreneurs contact information) and available subsidy
- To build local capacity on safe water provision, promotion, monitoring, and management

### **Expected Outcome:**

- Participants will understand about arsenic and its effect on health
- Participants will understand about various mitigation options
- Participants will know how to obtain, install, operate, and maintain an ABF
- Participants will make informed decision on appropriate safe water options

### **Participants:**

- 25 participants per VDC, including VDC members, health post workers, doctors (if any), teachers, and other relevant persons. It is desirable to have many women participants.
- Minimum of three staff from NRCS, ENPHO, or RWSSSP.
- One should be a Support Officer/Trainer/Supervisor who is familiar with water management, entrepreneur training, financing and subsidy options, and ABF promotion techniques.
- The other staff can be health workers or motivators who are familiar with arsenic and trained on ABF installation, operation, maintenance, and troubleshooting technique

### **Duration:**

- 6-7 hours

### **Materials Required:**

- |   |                     |
|---|---------------------|
| • Copy of this training guideline               | 1                   |
| • Copy of entrepreneurs list for all districts  | 1                   |
| • Assembled Gem505 Filter                       | 1                   |
| • Gravel (washed)                               | 4 L                 |
| • Coarse sand (washed)                          | 4 L                 |
| • Fine sand (washed)                            | 25 L                |
| • Piyush  | 2 bottles           |
| • Iron nails                                    | 5 kg                |
| • One liter measuring cup (Gem 016)             | 1                   |
| • Posters, 1 per participant                    | 25 plus some extra  |
| • Brochures, 5 per participants                 | 125 plus some extra |
| • Additional educational materials and aids     | some                |
| • Stationary (pens, notebooks) for participants | 25                  |
| • Video projector                               | 1                   |
| • Laptop computer                               | 1                   |
| • Camera  | 1                   |
| • Lunch and Refreshment                         | 30 people           |

**Activities:***Pre-workshop activities (1 week before actual workshop day)*

- Identify location for workshop (e.g. health post, VDC office, meeting hall, school)
- Inform VDC members, health post workers, teachers and other relevant persons about workshop date, time, and location
- Transport assembled filter and prepared & washed media to workshop location

*Detailed workshop activities*

<i>Activities</i>	<i>Duration (hours)</i>	<i>Remarks</i>
Registration, opening remarks	0.25	Collect names of all participants
General information on water quality, health, hygiene, sanitation	0.5	Use of video, posters and other visual aids
Information on arsenic, testing results, and its health effects	0.75	Show pictures of arsenicosis effects Explain health survey results
Tea break	0.25	
Discussion on mitigation options including ABF, dug well, etc Explain advantages and disadvantages of each options	0.5	Obtain opinions from VDC members on which options they prefer
Distribution of IEC materials	0.25	One ABF poster and five brochure for each participants Posters and stickers posted in easy to see places
Discussion on water provision, management, user payment, financing, subsidy, monitoring	1	Provide entrepreneur list including contact information
Lunch	1	
Demonstration on ABF installation, operation and maintenance, and monitoring	1.5	Demo ABF unit
Questions	0.5	More time if necessary
Total	6.5	

*Post-workshop activities*

- Arrange follow-up meeting to clarify any concerns and confusions
- Monitor new filters in August and September 2004

**Budget**

<i>Item</i>	<i>Units</i>	<i>Rate (NRs)</i>	<i>Total (NRs)</i>
Refreshment	30	20	600
Lunch	30	50	1,500
Stationeries	25	30	750
Other logistics	n/a	n/a	150
Total Expense per VDC			3,000

Note: Cost for demo filter, tools and IEC materials are not included above

## **Guidelines on Ward-Level Awareness Workshop**

### **Objectives:**

- To increase the awareness among villagers about water related diseases, health, hygiene, and sanitation
- To inform villagers of treatment options such as dug well and ABF
- To demonstrate the installation, operation, and maintenance of ABF
- To orient villagers on how to obtain a filter (local entrepreneurs contact information) and available subsidy

### **Expected Outcome:**

- Participants will understand about arsenic and its effect on health
- Participants will understand various mitigation options
- Participants will know how to obtain, install, operate, and maintain an ABF

### **Participants:**

- 50 villagers per ward. It is desirable to have as many women participants as possible.
- Minimum of two health workers from NRCS, ENPHO, or RWSSSP who are familiar with arsenic and trained on ABF installation, operation, maintenance, and troubleshooting technique

### **Duration:**

- 3 to 4 hours

### **Materials Required:**

- |  |                    |
|--|--------------------|
| • Copy of this training guideline              | 1                  |
| • Copy of entrepreneurs list for all districts | 1                  |
| • Assembled Gem505 Filter                      | 1                  |
| • Gravel (washed)                              | 4 L                |
| • Coarse sand (washed)                         | 4 L                |
| • Fine sand (washed)                           | 25 L               |
| • Piyush                                       | 2 bottles          |
| • Iron nails                                   | 5 kg               |
| • One liter measuring cup (Gem 016)            | 1                  |
| • Posters to be posted in the ward             | 5 plus some extra  |
| • Brochures for participants                   | 50 plus some extra |
| • Additional educational materials and aids    | some               |
| • Camera                                       | 1                  |
| • Refreshment                                  | 50 people          |

### **Activities:**

*Pre-workshop activities (1 week before actual workshop day)*

- Identify location for workshop (e.g. open space or at villager's home)
- Inform VDC and villagers about workshop date, time, and location

*Detailed workshop activities*

<i>Activities</i>	<i>Duration (hours)</i>	<i>Remarks</i>
Registration, opening remarks	0.25	Collect names of all participants
General information on water quality, health, hygiene, sanitation	0.25	Use of posters and other visual aids
Information on arsenic, testing results, and its health effects	0.5	Show pictures of arsenicosis effects Explain health survey results
Information on mitigation options including ABF, dug well, etc	0.25	Explain advantages and disadvantages of each options
Distribution of IEC materials	0.25	One ABF brochure for each participants Posters and stickers posted in easy to see places
Tea break	0.25	
Demonstration on ABF installation, operation and maintenance	1	Demo ABF unit
Information on how to obtain a filter, and available subsidy	0.25	Entrepreneur list is available at VDC and NRCS offices
Questions from villagers and Closing	0.5	More time if necessary
Total	3.5	

*Post-workshop activities*

- Obtain from local entrepreneurs name and address of users who have obtained a filter from the entrepreneurs. This will assist us to update our ABF database for easy future monitoring
- Obtain from subsidy provider name and address of users who have obtained filter subsidy. This will assist us to update our ABF database
- Monitor new filters in August and September 2004

**Budget**

<i>Item</i>	<i>Units</i>	<i>Rate (NRs)</i>	<i>Total (NRs)</i>
Refreshment	50	15	750
Other logistics	n/a	n/a	50
Total Expense per Ward			800

Note: Cost for demo filter, tools and IEC materials are not included above