



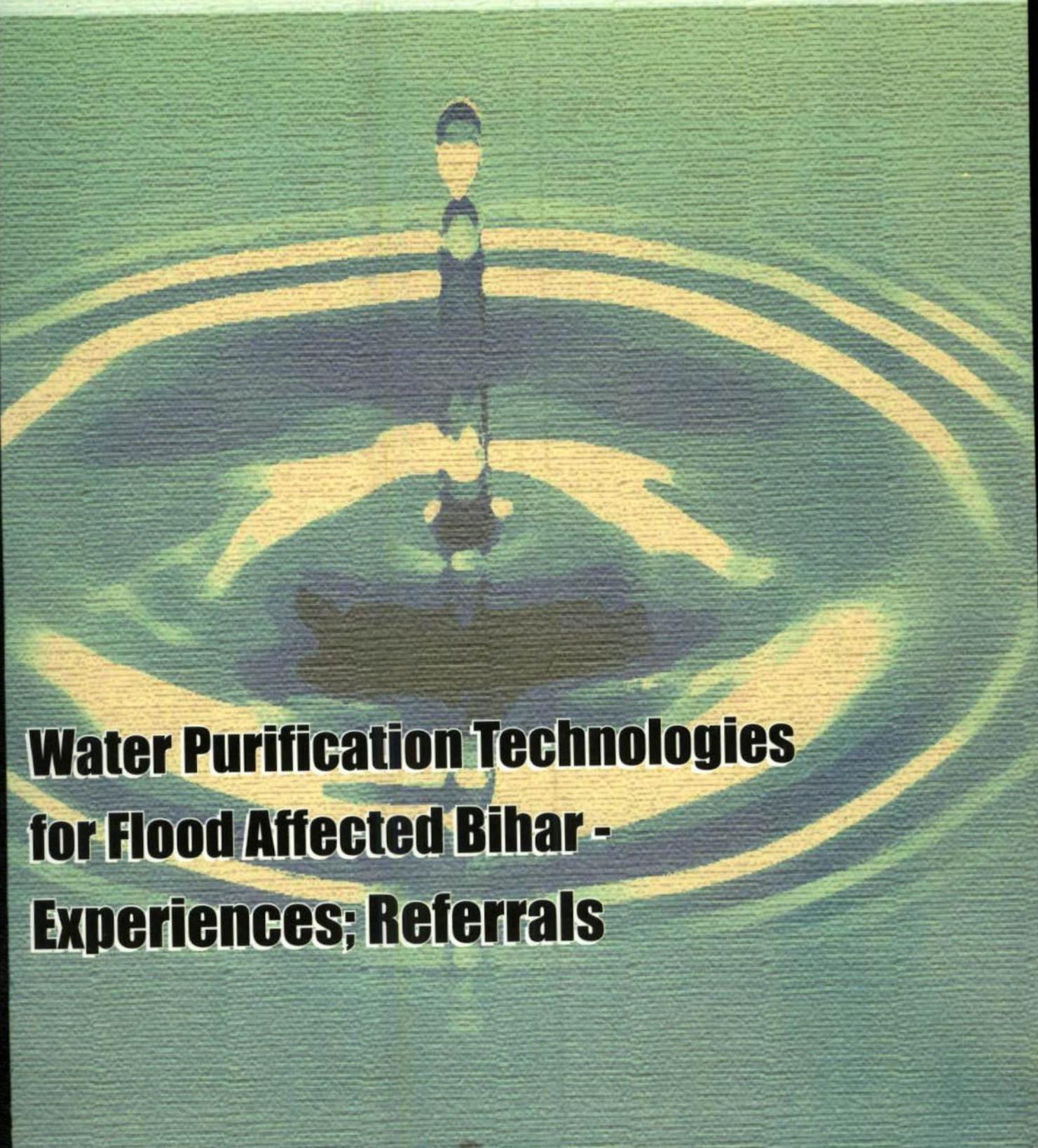
**Disaster Management
Community**



**Environment
Water Community**



Wider Choices
Smarter Development



**Water Purification Technologies
for Flood Affected Bihar -
Experiences; Referrals**



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Wider Choices
Smarter Development





Wider Choices
Smarter Development



Solution Exchange

An Initiative of the United Nations in India

In a country as large and vibrant as India, development workers operate in knowledge-rich environments where continuous experimentation and implementation of innovative ideas goes on. While some of this knowledge has been codified and shared, much of the larger pool knowledge gained through these experiences remain undocumented, out of the reach of practitioners, and in danger of being forgotten.

Attempting to harness this knowledge, the United Nations agencies in India support this knowledge-sharing initiative to help improve development effectiveness in support of achieving the objectives of India's Five-Year Plans and the Millennium Development Goals (MDGs).

The UN's Solution Exchange initiative builds **Communities of Practice (CoPs)**, by connecting people with similar concerns and interests through email groups and face-to-face interactions. The objective is to leverage India's knowledge pool to help ensure that no one "reinvents the wheel."

So far, Solution Exchange in India has established eleven Communities of Practice:

- AIDS
- Decentralization
- Disaster Management
- Education
- Food and Nutrition Security
- Gender
- ICT for Development
- Maternal and Child Health
- Microfinance
- Water
- Work and Employment

One new Environment Community on "Climate Change" will be launched in the near future."

Members use the Solution Exchange platform to share knowledge and experiences with colleagues facing professional challenges, offering them a range of options from first-hand field experience or existing research. In this, way, Solution Exchange is channeling the power and passion of the CoPs into more effective development interventions, and helping to reach India's development goals and the MDGs.



Disaster Management Community



Solution Exchange for the Disaster Management Community

The **Disaster Management Community** is a group of professionals from a wide range of organizations and disciplines concerned with preparedness, mitigation, response, recovery and rehabilitation issues with respect to disasters (natural and human induced).

Solution Exchange connects members of this Community and increases the effectiveness of their individual efforts, helping them share and apply each other's knowledge and experience. Through Solution Exchange, colleagues can turn to their peers across India for solutions to the day-to-day challenges they face.

Issues Covered

- Hazards: droughts, earthquakes, floods, fires, tsunamis, cyclones, landslides, avalanches, accidents (road, railroad, and air), extreme climate, dam failures, urban disasters, and nuclear, biological, chemical and industrial disasters
- Phases
 - Before: preparedness, mitigation, prevention, early warning, awareness, etc
 - During: emergency response, relief and rescue
 - After: response, rehabilitation/reconstruction and recovery
- Techniques and Tools: damage and vulnerability assessment formats, disaster resistant construction techniques and designs, retrofitting techniques and Standard Operating Procedures (SOPs), etc.
- Institutional and Policy Issues: governance in disaster management, role of coordination among various actors and mainstreaming disaster management into development work
- Addressing the concerns of vulnerable groups

For **further information** on the Disaster Management Community contact :
Click on the Disaster Management Community link

Resource Person and Moderator Disaster Management Community
Solution Exchange, United Nations
55 Lodhi Estate, New Delhi, Tel: 91-11-46532432 Fax: 91-11-24627612
E-mail: se-drm@solutionexchange-un.net.in
Go to <http://www.solutionexchange-un.net.in>



Environment Water Community



Solution Exchange for the Water Community

The **Water Community** is helping to promote sustainable and equitable access to water, particularly safe drinking water and sanitation facilities in urban and rural areas. It also promotes effective management in order to reverse unsustainable exploitation of water resources.

Solution Exchange for the Water Community helps members' efforts to increase effectiveness of water and environmental sanitation initiatives and programmes, by tapping into their collective knowledge.

Issues Covered

- ◆ Access, quality and effectiveness of water and sanitation service delivery
- ◆ Responsible management of water as a natural resource
- ◆ Unsustainable use of water
- ◆ Water pollution and contamination
- ◆ Inadequate delivery mechanisms and infrastructure
- ◆ Inefficient institutional and governance structures
- ◆ Financial resource constraints
- ◆ Socio-economic and cultural barriers to water access

For **further information** on the Water Community contact:
Click on the Water Community link

Resource Person & Moderator

Water Community
Solution Exchange, United Nations
73 Lodhi Estate, New Delhi : 3
Tel: 91-11-24690401; 91-11-24690257; Fax: 91-11-24627612
Email: se-wes@solutionexchange-un.net.in

Go to <http://www.solutionexchange-un.net.in>

Consolidated Reply

Members of the Disaster Management and Water Communities are part of a moderated mail group. The primary interaction in the community is through email. A member poses a query to the community and other members respond based on their experience and knowledge. The query can seek advice, experiences, examples or referrals.

The responses received within the time limit provided, are used by the Resource Team to formulate a Consolidated Reply (CR), which is then share it with all the members. The purpose of the CR is to give members a range of possible solutions to the issue raised.

The CR consists of summary of the responses, comparative experiences shared by members, details about recommended resources (like reports, articles, books, organizations, websites and experts) and all the responses received. The Resource Team also provides additional research relevant to the issue. The moderation of the responses, research support, attractive format and short turn around time are some of the special features of a CR.

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Disaster Management Community



Environment Water Community



Solution Exchange for the Disaster Management Community

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Consolidated Reply

Query: Water Purification Technologies for Flood Affected Bihar - Experiences; Referrals

Compiled by G. Padmanabhan and Nitya Jacob, Resource Persons and Nupur Arora and Ramya Gopalan, Research Associates

Issue Date: 9 September 2008

From [G. Padmanabhan](#), United Nation Development Programme (UNDP), New Delhi

Posted 1 September 2008

Floods that have displaced and stranded at least 2 million people in Northern Bihar continue to worsen. The flooding began last week when the Kosi River, known as the Saptakoshi in neighboring Nepal, burst its banks and changed course, inundating three of Bihar's northeastern districts - Supaul, Madhepura and Araria - an area that has not been affected by major monsoon flooding in more than 50 years.

Because prolonged flooding is a rarity in the area, it has been difficult for authorities to convince most people to evacuate. The Prime Minister visited the affected areas in Bihar and declared Bihar floods as national calamity. He also announced an immediate release of Rs 1,000 crores (US\$244 million).

As of 28 August the damage details in the state (Central government figures) are:

- Population affected: 2,668,000
- No. of human lives lost: 47
- No. of districts affected: 16
- No. of villages affected: 1,598

The state government is engaged in rescue and relief operations and claims to have adequate food. However, the lack of adequate drinking water and the unhygienic conditions in the camps are posing a high health risk. The National Disaster Management Authority has therefore, expressed the urgent need

of Water purification/treatment plants in large numbers to take care of the flood affected people both in India and Nepal.

In view of this I would request the members of Disaster Management and Water Communities to please share:

- What experiences and information do members have using various water purification technologies, especially those that can be used in Bihar?

- What organizations/individuals/service providers are you aware of who can be contacted to work with the Government of Bihar and other humanitarian agencies in the affected areas to install Water Purification/treatment plants?

We will collate and share this information with the Government (GoI and Bihar), donors and humanitarian agencies so that they can contact the service providers directly.

We sincerely request you to come up and share your expertise at this much needed hour.

Responses were received, with thanks, from

- 1 **Somnath Basu**, United Nations Children's Fund (UNICEF), Guwahati ([Response 1](#); [Response 2](#); [Response 3](#))
- 2 **Pooja Saxena**, International Federation for Red Cross and Red Crescent Societies, New Delhi
- 3 **Atal Behari Sharma**, Camp: Simrahi, Supaul ([Response 1](#); [Response 2](#))
- 4 **K. A. Benny**, CARE India, Tamil Nadu
- 5 **Zahir Abbas**, United Nations Development Programme (UNDP), Silchar
- 6 **Arshinder Kaur**, Organic Farming Council of Punjab, Mohali ([Response 1](#); [Response 2](#))
- 7 **Vishwanath Srikanataiah**, Biome and Argyam, Bangalore
- 8 **Sunil Uplap**, Tanclean Pvt. Ltd., Thane
- 9 **E. Mohamed Rafique**, UNAIDS India, New Delhi
- 10 **Anshu Sharma**, SEEDS India, New Delhi
- 11 **Abhishek Mendiratta**, Consultant, New Delhi ([Response 1](#); [Response 2](#))
- 12 **Dipan Shah**, Society for Environment Protection (SEP), Chennai
- 13 **K. Arup Kumar Patro**, FOCUS Humanitarian Assistance India, Avanigadda, Andhra Pradesh
- 14 **Hitesh Chakravorty**, District Elementary Education Office, Hailakandi, Assam
- 15 **Abhishek Singh**, United Nations Children's Fund (UNICEF), Patna
- 16 **Muhammad Iqbal**, Bio-Envoir Pte Ltd., Singapore
- 17 **Manish Kumar**, Technology Information Forecasting and Assessment Council (TIFAC), New Delhi
- 18 **Johnson Rhenius Jeyaseelan**, WaterAid India, Bhopal
- 19 **Premesh Balan**, Doshion Limited, Ahmedabad
- 20 **M. Jahangir**, Drinking Water-Pakistan, Islamabad
- 21 **Anurag Mishra**, Academy for Educational Development (AED), Lucknow
- 22 **Prakash Kumar**, SEI-United Nations Children's Fund (UNICEF), New Delhi ([Response 1](#); [Response 2](#); [Response 3](#)),
- 23 **M. Manoj Kumar**, Development Alternatives, New Delhi
- 24 **Rajesh Gopal**, Gujarat State AIDS Control Society (GSACS), Ahmedabad
- 25 **R. K. Rao**, Samata, Hyderabad ([Response 1](#); [Response 2](#))
- 26 **Krishnan S. Raghavan**, Asian and Pacific Centre for Transfer of Technology (APCTT), New Delhi ([Response 1](#); [Response 2](#))
- 27 **Raj Ganguly**, ACDI VOCA, New Delhi
- 28 **Prakash S. Kelkar**, National Environmental Engineering Research Institute (NEERI), Nagpur
- 29 **C. Balaji**, CARE, New Delhi
- 30 **Ravishwar Sinha**, Independent Consultant, New Delhi
- 31 **Praveen Kumar Amar**, Consultant on Disaster Management (Natural & Man Made), New Delhi ([Response 1](#); [Response 2](#))
- 32 **Alinawaz**, Focus Humanitarian Assistance India, Bhavnagar, Gujarat
- 33 **S. Khuntia**, Institute of Minerals and Material Technology, Bhubaneswar ([Response 1](#); [Response 2](#))
- 34 **Rahul Pathak**, CSR and Disaster Management Cell, Aquaplus Ltd., Pune
- 35 **Arunabha Majumder**, Presidency College, Jadavpur University, Kolkata
- 36 **Uday Bhawalkar**, Bhawalkar Ecological Research Institute (BERI), Pune

- 37 [Eric Lemétais](#), L2i Consultants, France
- 38 [Krishan Khanna](#), iwatch (www.wakeupcall.org), Mumbai
- 39 [J. Prakash](#), [Knowledgelinks](#), Ghaziabad
- 40 [N. M. Prusty](#), CARE, New Delhi
- 41 [Taral Kumar](#), Akar Impex (P) Ltd., Noida
- 42 [Pramel Gupta](#), Pragmatix Research and Advisory Services Pvt. Ltd, Bhopal
- 43 [Mazhar A. Rashidi](#), PRATINIDHI, Lucknow
- 44 [Sukanta Kumar Rath](#), Independent, Jagatsinghpur, Orissa
- 45 [Rita Salva](#), Independent Consultant, Mumbai
- 46 Yusuf Kabir, United Nations Children's Fund (UNICEF), Kolkata ([Response 1](#); [Response 2](#))
- 47 [H. S. Brahma](#), National Disaster Management Authority (NDMA), New Delhi
- 48 [Sudesh Menon](#), WaterHealth India Pvt. Ltd, Secunderabad
- 49 [B. K. Khanna](#), Consultant for National Disaster Management Authority (NDMA), New Delhi
- 50 [Rudra Rath](#), Orissa State Disaster Management Authority, Cuttack
- 51 [Shalina Mehta](#), Punjab University, Chandigarh
- 52 [Vinay Chopra](#), De Nora India Ltd., Kundaim, Goa
- 53 [Nimish Arora](#), Ion Exchange, Mumbai

Further contributions are welcome!

[Summary of Responses](#)

[Comparative Experiences](#)

[Related Resources](#)

[Responses in Full](#)

Summary of Responses

More than 65 members enthusiastically responded to the urgent query seeking experiences with water purification technologies for flood-affected Bihar. They shared information on a range of technologies viable for the current flood situation, listed organizations and service providers able to work in the region, and mentioned experiences using various water purification technologies.

Highlighting the importance of **good water purification technologies** during disaster situations, respondents shared **experiences from other disasters**. In [Assam](#), during flooding the government used a mixture containing Ferric Alum, lime and bleaching powder to purify turbid water and in [Gujarat](#), an NGO along with the People's Health and Development Trust (PHDT) developed a low-cost concept

called "Matka Filter" to filter water after the floods. In [Kerela](#) after the floods, technologies like Shock Chlorination, Shock Chlorination and Drip Chlorination were used.

Another experience, mentioned came from [Madhubani District, Bihar](#) where ION during the 2004 floods developed mobile Disaster Management Units for drinking water treatment to meet the critical need for safe drinking water. Also during the 2007 [Bihar](#) floods, [CARE India](#) supplied a water-purifying machine to affected areas, which had the capacity to purify between 1,200-1,500 liters of water every few hours. In addition members mentioned that Sodium Hypochloride Solution based technologies have worked well during previous floods in [Bihar](#). After the [Orissa](#) Super Cyclone, organization helped communities to fit TERAFILE red-clay filtration discs to household containers to filter high turbid water.

During the [Mumbai](#) floods in 2007, the Bhawalkar Ecological Research Institute (BERI) used Biosanitizer technology to purify floodwater. In 2004, TATA Projects Limited successfully used mobile water purification systems (e.g. the reverse osmosis system) in [Tamil Nadu](#) after the Tsunami. Also after the Tsunami, WaterHealth installed water purification and filtration system, in conjunction with ultra violet light disinfection technology in [Sri Lanka](#). They also took another initiative was taken up in [Andhra Pradesh](#), where more than 200 systems were installed.

Additionally, in Barmer District, [Rajasthan](#), NEERI provided Portable Instant Water Filter "NEERI-ZAR", to convert the turbid and contaminated rainwater into potable water during the 2007 floods.

Discussants also listed experiences from across India where **organizations** have successfully set up water purification measures after the Tsunami and recent floods. The [Indian Red Cross Society](#) following the Tsunami and during the 2006 and 2007 floods, deployed 13 portable water treatment plants, some of which were capable of purifying a 100,000 liters of water per day. [Water AID](#) in Kanyakumari District, [Tamil Nadu](#) provided potable drinking water sources and sanitation measures, and in [Bihar](#) under its Disaster Preparedness in Floods Programme provided water filters to affected communities. In addition, the Aga Khan Development (AKDN), working in Tsunami hit areas and geographically vulnerable villages in [Andhra Pradesh](#) have developed a "Hollow Fiber Ultra Filtration Membranes Technology" that can easily purify surface water.

Other organization mentioned, included the [Asian and Pacific Centre for Transfer of Technology](#), which as part of its technology information services developed water purification technologies to help disaster management and mitigation initiatives and the West Bengal Public Health and Education Department that has truck-mounted water treatment plants for treating floodwater, which it then distributes in plastic pouches in affected areas. They also noted the [USAID-funded Point-of-Use Water Disinfection and Zinc Treatment project \(POUZN\)](#) which is establishing commercially viable and scalable models for sustainable penetration of low-cost, high quality treatment methods among low-income communities. Also the [Department of Science and Technology](#), Pune has developed Membrane Based Technology for purifying contaminated water.

Finally, the [World Health Organization](#) (WHO) has produced a list of technologies for the "Emergency Treatment of Drinking Water at Point-Of-Use." They also noted that [Pedal Gen](#), a Singapore based technology, reported success post Tsunami as it filtered water from ponds.

Along with sharing experiences, respondents discussed in detail several [water purification technologies](#), they felt would be applicable to the current situation in Bihar. They also stressed the need to increase usage of [PUR\(R\) Purifier of Water](#) and [Solar Disinfection \(SODIS\)](#). They also mentioned about a new pump like gadget for [purifying water](#) available in the market

At the same time, discussants pointed out some challenges when using Point of Use technologies. They mentioned that these technologies often do not work for various reasons, such as being poorly made or inappropriate products, difficult or inconvenient to use, or not cost effective. Moreover, members felt

emphasis must be on community mobilization, social marketing and behavior change, not products and technologies. Therefore, they stressed the need for a rigorous communication plan involving all partners in the communication loop, along with water purification technologies.

Additionally, members outlined the [minimum standards](#) that states can use for distributing water during emergencies and disaster situations. They also voiced concerns over the high risk of diarrhea and water borne diseases after floods disaster and suggested taking preparedness measures to prevent health and sanitation related problems. Here they recommended [Calcium Hypochlorite for Diarrhoeal Outbreaks technology](#), which has been successful in previous disasters.

In the end, respondents expressed interest in taking the discussion a step further by looking at longterm drinking water supply schemes for flood-affected districts.

Recommended Tools and Technologies

Solar Disinfection (SODIS) (from [Vishwanath Srikanataiah](#), Biome and Argyam, Bangalore; [Anshu Sharma](#), SEEDS India, New Delhi; [Zahir Abbas](#), United Nations Development Programme, Silchar; [M. Manoj Kumar](#), Development Alternatives, New Delhi; [R. K. Rao](#), Samata, Hyderabad; [Krishan Khanna](#), iwatch, Mumbai and [Anurag Mishra](#), AED, Lucknow)

Process; Owned by Sodis Reference Center, Switzerland

Available at <http://www.sodis.ch/index.htm>; Eawag/Sandec, Ueberlandstrasse 133, CH-8600 Duebendorf, Switzerland; Tel: 591-4429-77-39; Fax: 591-4-448-79-86

Virtually a no-cost process, involves putting contaminated water in closed PET bottles, and exposing it to sunlight for a few hours, works on heat as well as ultra-violet radiation

Na DCC Tablets (from [Somnath Basu](#), United Nations Children's Fund (UNICEF), Guwahati ([Response 1](#); [Response 2](#); [Response 3](#)))

Tool; Available at Water Chem Laboratories, 11-6-652/1, 1st Floor, Red Hills, Hyderabad 50004 Andhra Pradesh; Tel: 91-040-3300428/6508696; Fax: 91-040-3300428

Produces NaDCC tablets, 33 mg tablets can purify approximately 20 litres of non-turbid water, used by the Assam Public Health and Engineering Department

"Matka Filter" (Pot-Based Filter) (from [Dipan Shah](#), Managing Coordinator, Society for Environment Protection (SEP), Chennai)

Tool; Contact: Mr. Dipan Shah, Managing Coordinator, Society for Environment Protection (SEP), D-2, Keshav Apartment, Memnagar, Ahmedabad - 380 052; Tel: (079) 6513 7987; www.sepindia.org

Method necessitates fixing a normal filtration candle to an earthen pot, and then boiled water is added for filtration.

Sinking Hand Pumps (from [Atal Behari Sharma](#), Camp: Simrahi, Supaul; [response 1](#))

Technology; Contact: Atal Behari Sharma, Camp: Simrahi, Supaul [at atalsharma@gmail.com](mailto:atalsharma@gmail.com)

In cases where there are enough pumps in the flood affected area, it is one of the fastest and easiest way is to provide drinking water

Saree Method (from [Zahir Abbas](#), United Nations Development Programme (UNDP), Silchar)

Process: Contact: Zahir Abbas, United Nations Development Programme (UNDP), Silchar at z.a.mazumder@gmail.com

Local method of purifying water used in Bangladesh, where people use a normal length saree, fold it into eight sections, put it on top of a vessel, and pour water through it into the vessel.

PUR(R) Purifier of Water (from [Vishwanath Srikanataiah](#), Biome and Argyam, Bangalore)

Contact: the Procter and Gamble at <http://www.pg.com/getintouch/index.shtml>

Simple, cost-effective home-based water purification system that removes dirt and disease-causing pathogens from drinking water within minutes, comes in a sachet- simultaneously removes coagulation and turbidity and disinfects

From [E. Mohamed Rafique](#), UNAIDS India, New Delhi

Shock Chlorination

Technology; Contact: E. Mohamed Rafique, UNAIDS India, New Delhi at emohamed.rafique@un.org.in

Method requires the addition of 5-10 mg/liter of chlorine powder, bleach or liquid bleach to water in a well and allowing it to remain unused for a few hours, the first water drawn from the well after the disinfection period must be discarded, subsequently normal water use can resume. [Read more](#)

Pot Chlorination

Technology; Contact: E. Mohamed Rafique, UNAIDS India, New Delhi at emohamed.rafique@un.org.in

Bleach or chlorine powder and gravel mixture must be put in a chlorination pot (or a small container, with a few holes punched in it) and placed inside a larger vessel with holes in it- the chlorine is dispersed from the double-layered pot slowly and purifies the water. [Read more](#).

Drip Chlorination

Technology; Contact: E. Mohamed Rafique, UNAIDS India, New Delhi at emohamed.rafique@un.org.in

Used for continuously flowing water bodies (i.e. a small stream), and requires a small check dam or bund to divert water through a pipe to a tank, which has a provision for overflow, then liquid chlorine in a plastic bottle is dripped via a needle submerged in the water tank (the chlorine flow can be regulated by a squeeze valve on its outlet). [Read more](#)

Hollow Fiber Ultra Filtration Membranes Technology: (from [K. Arup Kumar Patro](#), FOCUS Humanitarian Assistance India, Avaniigadda, Andhra Pradesh)

Contact: Aquaplust Water Purifiers Pvt Ltd 4, Pragati Apartments, Lane No 3, Dahanukar Col, Kothrud, Pune 411038, Maharashtra; Tel: 91-20-25434133; sales@aquaplusltd.com; <http://www.aquaplusltd.com/uvunit.html>

Can easily be used by communities during or after a disaster to purify surface water, because the instruments work with or without power and are user friendly.

Ozonation: (from [Abhishek Singh](#), United Nations Children's Fund (UNICEF), Patna and Nimish Arora, Ion Exchange, Mumbai)

Contact: ION Exchange India Ltd., Tiecicon House, Dr. E. Moses Road, Mahalaxmi, Mumbai 400011 Maharashtra; Tel: 91-22-3989-090; Fax: 91-22-2493-8737; hocro@ionexchange.co.in; <http://www.ionindia.com/disaster.html>

Used by the INDION mobile Disaster Management Unit (DMU) to treat any kind and quality of surface or high salinity ground water to produce drinking water conforming to stringent IS 10500 standards. Read more

Pedal Gen: (from [Muhammad Iqbal](#), Bio-Envoir Pte Ltd., Singapore)

Contact: Muhammad Iqbal, Bio-Envoir Pte Ltd., Singapore info@bio-envoir.com

Portable water filter, which filters and produces 1,500 liters of water every hour, can be continuously operated 24/7.

Purion (from [Manish Kumar](#), Technology Information Forecasting and Assessment Council (TIFAC), New Delhi)

Contact: National Chemical Laboratory, Dr. Homi Bhabha Road, Pune 411008 Maharashtra; Tel: 91-20- 25902000; Fax: 91-20-25902601 naa@ncl.res.in; www.ncl-india.org

Manual membrane-based technology requiring no energy and provides water free from biological contamination.

Calcium Hypochlorite: (from [Somnath Basu](#), United Nations Children's Fund (UNICEF), Guwahati [response 2](#) and [Anurag Mishra](#), Academy for Educational Development (AED), Lucknow)

Contact: Somnath Basu, United Nations Children's Fund (UNICEF), Guwahati at sbasu@unicef.org and Anurag Mishra, Academy for Educational Development (AED), Lucknow at anuraganthro1@rediffmail.com

Used mainly to purify water for combating during diarrhea outbreaks in health camps. Read more. Read more

From [M. Manoj Kumar](#), Development Alternatives, New Delhi

Sand Filtration Technique

Contact: [M. Manoj Kumar](#), Development Alternatives, New Delhi

Traditional technique used to arrest the pathogens, very effective in flood situations

Ceramic Filters

Contact: [M. Manoj Kumar](#), Development Alternatives, New Delhi

Used mostly by communities in remote areas under various programmes

Halogen or Chlorine Tablets: (from [Abhishek Mendiratta](#), Consultant, New Delhi; [response 2](#))

Contact: National Research Development Corporation (A Government of India Enterprise), 20-22,, Zamroodpur Community Centre, Kailash Colony Extension, New Delhi 110048; Fax 91-11 - 29240409/29240410/29230506; Tel: 91-11-29240401 to 29240408; write2@nrdcindia.com; www.nrdcindia.com

The household level and bleaching powder at source, residual chlorine in water after the disinfection can be checked with a chloroscope

H₂S Vials (from [Abhishek Mendiratta](#), Consultant, New Delhi; [response 1](#))

Tools: Bacteriological Tester; Available at Development Alternatives; B-32 TARA Crescent, Qutab Institutional Area, New Delhi 110016; Tel.: 91-11-26890380; <http://www.indiawaterportal.org/data/kits/h2s.html>

These bottles that can check bacteriological contamination in water, by storing water in them for 16 to 24 hrs in the H₂S vial bottles changes its color

Moringa Oleifera Seeds (from [Raj Ganguly](#), ACDI VOCA, New Delhi)

Contact: Raj Ganguly, ACDI VOCA, New Delhi at rajganguly1@gmail.com

Cheap way to purify water, the seeds treat water on two levels, acting both as a coagulant and an antimicrobial agent. Read more

Drinking Straw (from [Ravishwar Sinha](#), Independent Consultant, New Delhi)

Contact: Ravishwar Sinha, Independent Consultant, New Delhi at ravishwar@gmail.com
Handy technique, and requires some suction, but make turbid water drinkable

Fuel Wood Ash (from Praveen Kumar Amar, Consultant, Disaster Management-Natural & Man Made, New Delhi; [response 1](#))

Contact; Praveen Kumar Amar, Consultant, Disaster Management-Natural & Man Made, New Delhi [at pkindconsul@hotmail.com](mailto:pkindconsul@hotmail.com)

Water and ash are mixed and kept for two hours, then filtered- it provides safe water for consumption in emergencies

Portable Instant Water Filter "NEERI-ZAR" (from [Prakash S. Kelkar](#), National Environmental Engineering Research Institute (NEERI), Nagpur)

Contact: National Environmental Engineering Research Institute (NEERI), **Nagpur**

Nehru Marg, Nagpur, 440020 Maharashtra; Tel: 91-712-2249885-88; Fax: 91-712-2249900; rasohony@neeri.res.in

Way to rapidly treat water supply in unapproachable areas with no electric supply, provides onsite treatment to remove organic contamination, suspended solids and bacteria

Biosanitizer Ecochips (from [Uday Bhawalkar](#), Bhawalkar Ecological Research Institute (BERI), Pune)

Tools; Contact; Uday Bhawalkar, Bhawalkar Ecological Research Institute (BERI), Pune) [at bhawalkar@dataone.in](mailto:bhawalkar@dataone.in)

Dropped in floodwater to clean the connected water body, after using the chips water will be able to "self-settle" and the supernatant clear water can be safely consumed. Read more

Electrochlorinators (from [Krishan Khanna](#), iwatch (www.wakeupcall.org), Mumbai)

Contact: De Nora India Ltd, Plot Nos. 184, 185 & 189, Kundaim Industrial Estate, Kundaim, Panjim, Goa ; <http://www.alibaba.com/member/in100335223/aboutus.html>; <http://www.titanor.com/>

Work on solar power and use ordinary salt as raw materials

Filtration and Disinfection (from [Taral Kumar](#), Akar Impex (P) Ltd., Noida)

Process: Contact: Taral Kumar, Akar Impex (P) Ltd., Noida [at taralkumarv@hotmail.com](mailto:taralkumarv@hotmail.com)

Filters polluted river water and convert it to drinking water while removing the silt and sand and disinfecting it for making, it fit for human consumption.

Vani (from [Rita Salva](#), Independent Consultant, Mumbai)

Process: Contact: Rita Salva, Independent Consultant, Mumbai [at drritasavla@yahoo.co.in](mailto:drritasavla@yahoo.co.in)

Traditional system followed by the Jain community, ash from firewood and cow dung are mixed with water and kept in the sun for 45 minutes, this acts as a catalyst to kill bacteria

Reverse Osmosis: (from [Alinawaz](#), Focus Humanitarian Assistance India, Bhavnagar, Gujarat)

Process: Contact: By Alinawaz, Focus Humanitarian Assistance India, Bhavnagar, Gujarat [at alinawaznanjee@gmail.com](mailto:alinawaznanjee@gmail.com)

Process where water is forced through a semi-permeable membrane by applying strong pressure, thereby only fine water molecules are allowed to pass through- all contaminants, such as bacteria, viruses, herbicides, heavy metals and chemical poisons are removed

Using TERAFIL Red-Clay Filtration Disc (from S. Khuntia, Institute of Minerals and Material Technology, Bhubaneswar; [response 2](#))

Tool: Contact; National Institute of Rural Development, Rajendranagar, Hyderabad 500030, Andhra Pradesh, Tel: 91-40-24008522, Fax: 91-40-24015277, <http://www.jalmandir.com/filtration/terafil/filterdisc.html>

Disc is fitted with any household container to filter high turbid water, very effective

From Krishnan S. Raghavan, Asian and Pacific Centre for Transfer of Technology (APCTT), New Delhi; [response 1](#)

Zero-B Srijal Low-Cost Disinfecting Unit

Tool: Contact: Available at Ion Exchange (India) Ltd., Tiecicon House, Dr. E. Moses Road, Mahalaxmi, Mumbai 400011 Maharashtra; Tel.: 91-22-39890909; Fax: 91-22-24938737; hocro@ionexchange.co.in, <http://www.ionindia.com>

Purifies water through a two-stage purification process and does not require piped water or electricity. [Read more](#)

Zero-B Suraksha

Tool: Contact: Available at Ion Exchange (India) Ltd., Tiecicon House, Dr. E. Moses Road, Mahalaxmi, Mumbai 400011 Maharashtra; Tel.: 91-22-39890909; Fax: 91-22-24938737; hocro@ionexchange.co.in, ieil@ionexchange.co.in; <http://www.ionindia.com>

Economical on-tap purifier based on the Zero-B resin technology, unit is simple, convenient and does not require electricity. Read more

Jalshudhi Disinfection Capsules

Tool: Contact: Available at Ion Exchange (India) Ltd., Tiecicon House, Dr. E. Moses Road, Mahalaxmi, Mumbai 400011 Maharashtra; Tel.: 91-22-39890909; Fax: 91-22-24938737; hocro@ionexchange.co.in, ieil@ionexchange.co.in; <http://www.ionindia.com>

Low-cost, easy-to-use capsules that remove soil sediments and bacteria to provide safe drinking water. Read more

Membrane Filtration Based Water Purifier (from (from Krishnan S. Raghavan, Asian and Pacific Centre for Transfer of Technology (APCTT), New Delhi; [response 2](#))

Requires no electricity, and can be set up in 10 minutes even in the remotest areas- cleans water of suspended particulate matter, bacteria and harmful viruses

Common Biosand Technique (from [M. Jahangir](#), Drinking Water-Pakistan, Islamabad)

Contact: Centre for Affordable Water and Sanitation Technology; Box #12, 2916 5th Avenue NE, Calgary, Alberta, Canada; Tel.: 01-403-2433285; Fax: 01-403-2436199; cawst@cawst.org; <http://www.jalmandir.com/filtration/biosand/biosand-filters.html>

With a little pretreatment of Pot: Al Sulphate (Phatkry) and settling time, before feeding to the sand filter, this method is tried in earthen long pitcher

Comparative Experiences

Assam

Use of Ferric Alum, Lime and Bleaching Powder (from Somnath Basu, United Nations Children's Fund (UNICEF), Guwahati; [response 2](#) and [Hitesh Chakravorty](#), District Elementary Education Office, Hailakandi, Assam)

During the Assam floods the PH ED, Government of Assam pursued a water purification methodology. The 100 gms sachet used contained Ferric Alum, Lime and Bleaching Powder and each packet purified approximately 20 litres of turbid water. Ferric Alum, Lime and bleaching powder are contained in small packets separately in powder form. Space is also arranged for in advance to grind the Ferric Alum & Lime.

Bihar

Water Purifying Machine used in 2007 Floods (from [C. Balaji](#), CARE, New Delhi)

GE Company gifted a water purifying machine to CARE India during 2007 Bihar floods, with capacity to purify about 1200-1500 litres of water every few hours. However capacity to filter water came down by about 20% after a few weeks as the filters were clogged. The filter machine, mounted on an auto-rickshaw type vehicle, was taken around village by village, serving the needs of 10,000 families and was very well accepted with no reported infection

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INDION mobile DMU for drinking water treatment was developed to meet the critical need for safe drinking water during disasters. It treats any kind and quality of surface or high salinity ground water for drinking water of IS 10500 standards and consists of membrane processes and ozonation modules which can be used in combination. During 2004 floods, it was found to be compact, containerised and skidmounted allowing quick transport to affected areas. Read [more](#)

Sodium Hypochloride Solution (from [Anurag Mishra](#), AED, Lucknow)

This is a CDC approved product and a social marketing product by PSI, effectively used in Bihar floods. It is in the form of a liquid, packed in small plastic bottle, sufficient enough to purify about 1000ltrs of water. Although it cannot remove physical impurities, it can help in averting microbial contamination. The product cost about 10Rs for a household and lasts for 1.5 to 2 months. This has been taken up by rural communities in very positive ways.

Andhra Pradesh

Hollow Fiber Ultra Filtration Membranes Technology (from [K. Arup Kumar Patro](#), FOCUS Humanitarian Assistance India, Avanigadda, Andhra Pradesh)

AKDN is working in Tsunami hit as well as geographically vulnerable villages of Nagaylank Mandal frequently affected by cyclones and seasonal flash floods. Thus, to address the issue of fresh water availability, AKDN supplied this emergency water treatment technology in all operational villages in stock piles by village and by region. Communities use this system very easily to purify surface water during or post disaster and it can work without power. Read more

Potable Water Purification Systems (from [Sudesh Menon](#), WaterHealth India Pvt. Ltd, Secunderabad)

WaterHealth India provided more than 200 safe potable water purification systems in remote rural villages of Andhra Pradesh. The WaterHealth Centre is scalable and can provide water to communities with population varying from 2,500 to 10,000 people. Similar systems have been installed systems in Sri Lanka after the Tsunami.

Gujarat

Matka Filter Using Filter Candle (from [Dipan Shah](#), Managing Coordinator, Society for Environment Protection (SEP), Chennai)

During Gujarat floods, SEP and PHDT developed a low cost concept called "Matka Filter" and fixed a normal filtration candle in the earthen pot. A common candle costs Rs. 50 to 75 per piece and whole assembly costs Rs. 100 to Rs. 150 and can be distributed widely on one per family basis. Normal water is boiled and then introduced into this pot. The making of this filter also provides a livelihood activity in itself.

Kerala

From [E. Mohamed Rafique](#), UNAIDS India, New Delhi

Shock Chlorination Method Used to Eliminate Threats to Water

This is a one-time addition of chlorine powder, bleach or liquid bleach to the water body done by adding 5-10 mg/liter to the water in a well and allowing it to remain unused for a period of a few hours. This is used in the remote hills of the state. The first water drawn from the well after disinfection period is discarded and normal use is subsequently resumed. Shock chlorination can eliminate transient threats to water quality.

Pot Chlorination Method to Purify Water

Used in the remote hills of the state, this includes a small container, with a few holes punched in it, filled with chlorine powder and gravel mixture and placed inside a larger vessel also with holes punched in it. The chlorine disperses from the double layered pot slowly, with the number and size of holes controlling the disinfectant dose and tailored to match a specific well, tank or water body volume and the withdrawal or run off rate from this water source.

Drip Chlorination Method of Flowing Water

The method, is used in hills where the water body to be chlorinated has a continuous flow like a running stream. A small check dam or bund diverts water to a tank, through a pipe. Liquid Chlorine is filled in the plastic bottle from which it can be regulated by a squeeze valve, on its outlet. Regular supervision, change of bottles and high costs were found to be setbacks.

Maharashtra

Rainwater Harvesting and Flood Control Using Biosanitiser, Mumbai (from [Uday Bhawalkar](#), Bhawalkar Ecological Research Institute (BERI), Pune)

Soil has a built-in mechanism to restrict the entry of polluted water into groundwater. Soil, thus, can soak in just 10 mm/d of polluted water. Upon applying biosanitiser in the surface water pool, one can find that water starts penetrating much faster, up to 1,000 mm/d. This was used during the Mumbai monsoons which caused a deluge in the Powai-Vihar lake area thus enabling effective flood control, rainwater harvesting and groundwater recharge.

Orissa

TERAFIL Red-Clay Filtration Disc (from [S. Khuntia](#), Institute of Minerals and Material Technology, Bhubaneswar)

This filter can be fitted with any household container for filtration of high turbid water. It was tested during the super cyclone period in the State and was highly successful in the effective filtration of high turbid water. It removed 99% of turbidity and 95% of bacteria in water during filtration.

Rajasthan

Portable Instant Water Filter, Barmer District (from [Prakash S. Kelkar](#), National Environmental Engineering Research Institute (NEERI), Nagpur)

NEERI installed 100 units in the District's flood affected remote areas in October 2006 to convert turbid and contaminated rainwater into potable water through onsite treatment. Performance of these units under field conditions was evaluated and opinion of local people was recorded. People using treated water from these units were very happy with the supply of water to inaccessible villages and quality of water produced by NEERI-ZAR units.

Tamil Nadu

Reverse Osmosis Water Purification Technology, Nagapattinam (from [Sukanta Kumar Rath](#), Independent, Jagatsinghpur, Orissa)

TATA projects used this mobile water purifying vehicles during their relief operations in the aftermath of TSUNAMI to purify saline water. They designed mobile water purification systems, fitting the RO system in a vehicle, thus providing water to the affected villagers on emergency. 10*12**10 space is required for mounting the R.O system for 1000/1500/2000 LPH (Litre per hour) capacity water purification plant.

Drinking water and Sanitation services (from [Johnson Rhenius Jeyaseelan](#), WaterAid India, Bhopal)

Water AID in Kanyakumari District, Tamil Nadu provided potable drinking water sources and sanitation measures, and in Bihar under its Disaster Preparedness in Floods Programme provided water filters to affected communities in 5 districts before the floods. These filters can be given to all relief centres to get purified water. The water filters of Hindustan Unilever costs around Rs. 1800.

All India

Solar Disinfection a No-Cost Approach to Purifying Water (from [Anshu Sharma](#), SEEDS India, New Delhi)

A virtually no-cost process of exposing available contaminated water in closed PET bottles (found in recycling and solid waste sector) to sunlight for a few hours. Bottles are kept on rooftops, and can be partly painted black to increase heat gain. If cloudy conditions prevail, exposure time is increased. However it does not remove chemical contaminants, is not fully effective in turbid water and requires investment in education for its promotion.

Membrane-Based Technology Removes Biological Contamination (from [Manish Kumar](#), Technology Information Forecasting and Assessment Council (TIFAC), New Delhi)

National Chemical Laboratory, Pune, supported by DST developed this technology, Purion, which is membrane based. The unit is completely manual, requires no energy and provides water free from biological contamination. It is therefore unique and is used in flood conditions as well as in rural areas where electricity is unavailable and river water is the only source of drinking water. Read more

Deployment of Portable Water Treatment Plants (from [Pooja Saxena](#), International Federation for Red Cross and Red Crescent Societies, New Delhi)

The Indian Red Cross Society owns 13 portable water treatment plants of different capacities and deployed these units during disasters like the Tsunami, floods in 2006 and 2007 and in Jammu and Kashmir earthquake. Three of them are currently being deployed in Bihar. The water treatment plants purify 100,000 litres of water per day.

Pedal Gen Product Used in Tsunamis Affected Areas (from [Muhammad Iqbal](#), Bio-Envoir Pte Ltd., Singapore)

A product from Singapore, reported success post Tsunami as it filtered water from ponds; water logged areas and delivered water immediately. It is portable, with or without a cycle, filters and produces 1,500 litres of water each hour with continuous operation. It does not need power nor chemicals or purificants, instead uses micro filters guaranteed to remove bacteria and viruses, and can be used continuously for three years without replacement.

Calcium Hypochlorite for Diarrhoeal Outbreaks (from Somnath Basu, United Nations Children's Fund (UNICEF), Guwahati; [response 2](#) and Anurag Mishra, Academy for Educational Development (AED), Lucknow)

Calcium Hypochlorite (65% - 70% active Cl) is used in case of diarrhoeal outbreaks for both water purification and hospital/ health camp management. A stock solution is prepared mixing 15 grams, i.e., 1 level Table spoon or 3 level Tea spoons of Calcium Hypochlorite - 70% in 1 litres of water. This stock solution lasts for about 1 month. For water purification 0.6 ml or 3 drops of the solution is mixed in 1 litre of raw water and is found very effective.

'PUR' Water Purifying Mixture (from R. K. Rao, Samata, Hyderabad and Vishwanath Srikanataiah, Biome and Argyam, Bangalore; [response 1](#))

Available in sachets and marketed by P&G Markets through its social marketing unit-Peoples Services International; each sachet is sufficient to treat 10 liters of turbid water. PUR contains mixture of ferric alum and bleaching powder, as ready stuff tested and approved by WHO; and removes turbidity and deactivates all pathogens. It costs around Rs. 5 per sachet.

From Krishnan S. Raghavan, Asian and Pacific Centre for Transfer of Technology (APCTT), New Delhi; [response 1](#)

Zero-B Srijal Low-Cost Disinfecting Unit

Water passing through Srijal undergoes a two-stage purification process. First, a filter pad removes suspended dirt and mud, and then the water passes through a Zero-B resin chamber where harmful bacteria and viruses are eliminated. This unit does not require piped water or electricity and is used in rural and disaster affected areas.

Zero-B Suraksha Economical Tap Purifier

Zero-B Suraksha unit is an economical on-tap purifier based on the Zero-B resin technology. The unit is simple, convenient and does not require electricity. Thus, it is widely used in rural and disaster affected areas and also in urban households.

Jalshudhi Disinfection Capsules Easily Remove Sediment and Bacteria

These capsules are low-cost, and easy-to-use that remove the soil sediments and bacteria completely and provide a safe drinking water. Jalshudhi capsules not only effectively disinfect water but also purify muddy, turbid water. The capsules come in two capacities - Jalshudhi-01 can purify 1 litre of water and Jalshudhi-05 can purify 5 litres. The residual purifying effect lasts 48 hours.

Pump like Gadget for Purifying Water (from [B. K. Khanna](#), Consultant for National Disaster Management Authority (NDMA), New Delhi)

This was recently introduced in the market, similar to a cycle pump but shorter weighing less than 3 kgs. It has two pipes, one in the dirty water and the other in an empty bottle, or bucket. Once the top is pumped, drinking water comes in to the bucket/bottle. The smaller version costs about 12000/- and 50,000 litres of water can be pumped with one candle. Bigger versions and changes are also available thus ideal for a flood situation.

Related Resources

Recommended Tools and Technologies

For all shared tools and technologies click [here](#)

Recommended Organizations and Programmes

United Nations Children's Fund (UNICEF), New Delhi (from Somnath Basu, [response 1](#) and [Abhishek Mendiratta](#), Consultant, New Delhi)

73, Lodi Estate, New Delhi 110003; Tel.: 91-11-24690401/24691410; Fax: 91-11-24627521/24691410; newdelhi@unicef.org; <http://www.unicef.org/wes/indexemergency.html>; Contact Mr. S. N. Singh, UNICEF Bihar Office; Patna 8 Patliputra Colony Patna Bihar

Provided immediate assistance to ensure continued and effective functioning of water and sanitation systems during the Tsunami, followed by rehabilitation and reconstruction programmes

Assam Public Health and Engineering Department, Guwahati (from Somnath Basu, UNICEF, Guwahat, *response 2i*)

Block B, Assam Secretariat, Dispur, Guwahati 781006 Assam; <http://aphe.nic.in/calamityfr.htm>

APHED with respect to ensuring safe drinking water to the flood affected population provides water treatment technologies during floods in Assam.

From [K. Arup Kumar Patro](#), FOCUS Humanitarian Assistance India, Avanigadda, Andhra Pradesh

Aquaplust Water Purifiers Pvt. Ltd, Pune

4, Pragati Apartments, Lane No 3, Dahanukar Col, Kothrud, Pune 411038, Maharashtra; Tel: 91-20- 25434133; sales@aquaplust.com; <http://www.aquaplust.com/uvunit.html>

Manufacturers water purifiers based on ultra-violet technology at very low cost that can be deployed in home, including in disaster situations

Aga Khan Development Network (AKDN), New Delhi

<http://www.akdn.org/india.asp>

Dedicated to improving living conditions and opportunities for the poor, without regard to their faith, origin or gender

Ion Exchange India Ltd, Mumbai (from [Abhishek Singh](#), UNICEF, Patna and Nimish Arora)

Tiecicon House, Dr. E. Moses Road, Mahalaxmi, Mumbai 400011 Maharashtra; Tel: 91-22-3989-090; Fax: 91-22-2493-8737; hocro@ionexchange.co.in; <http://www.ionindia.com/disaster.html>

Developed the INDION mobile Disaster Management Unit for drinking water treatment to meet the need for safe drinking water during disasters

WaterHealth, Secunderabad (from [Sudesh Menon](#), WaterHealth India Pvt Ltd, Secunderabad)

No. 206, Ashoka My Home Chambers, 1-8-301, S. P. Road, Secunderabad 500003 Andhra Pradesh; Tel: 91-40-2789-0307/08/09; Fax: 91-40-2789-030; DPatnaik@corp.waterhealth.com; www.waterhealth.com; Contact Sudesh Menon

Focuses on providing safe potable water in remote rural villages and has installed more than 200 systems in villages of Andhra Pradesh and also in Sri Lanka

TATA Projects Limited, Secunderabad (from [Sukanta Kumar Rath](#), Independent, Jagatsinghpur, Orissa)

Mithona Towers1, Opposite Wesley Co-ed. Jr. College, Prenderghast Road, Near Paradise Circle, Secunderabad 500003 Andhra Pradesh; Tel: 040-6623-8801; Contact: Mr. A. Venkateshwar, Vice President, Corporate Affairs Department; a.venkateshwar@tataprojects.com

Has designed mobile water purification systems i.e. the reverse osmosis system is fitted in a vehicle which can provide water to the affected villagers on emergency.

From Krishan Khanna, iwatch (www.wakeupcall.org), Mumbai

De Nora India Ltd, Goa

Plot Nos. 184, 185 & 189, Kundaim Industrial Estate, Kundaim, Panjim, Goa;

<http://www.alibaba.com/member/in100335223/aboutus.html>; <http://www.titanor.com/>

Has brought to India, the latest technologies of the De Nora Group, Italy and has made Electrochlorinator that can be used for eater purification

International Federation for Red Cross and Red Crescent Societies (IFRCRCs), New Delhi (from [Pooja Saxena](#))

1, Red Cross Road, New Delhi 110001; Tel: 91-11-23716441; Fax: 91-11-23717454; www.indianredcross.org

Voluntary humanitarian organization, owns 13 portable water treatment plants of different capacities and has been deploying these units in event of disaster like in Tsunami.

WATER Aid, New Delhi (from [K. A. Benny](#), CARE, Tamil Nadu)

First floor, Nursery School Building, Gate No 1, C3, Vasant Kunj, New Delhi 110070; Tel: 911146084433; <http://www.wateraid.org>

International charity working on addressing poverty issues by enabling the world's poorest people to gain access to safe water, sanitation and hygiene education and is working on Bihar floods

From [Manish Kumar](#), Technology Information Forecasting and Assessment Council, New Delhi

National Chemical Laboratory (NCL), Pune

Dr. Homi Bhabha Road, Pune 411008 Maharashtra; Tel: 91-20-25902000; Fax: 91-20-25902601 naa@ncl.res.in;
www.ncl-india.org

Research, development and consulting organisation with a focus on chemistry and chemical engineering, has developed water purification technology called Purion.

Department of Science and Technology, New Delhi

Technology Bhavan, New Mehrauli Road, New Delhi 110016; Tel: 91-11-26567373; Fax: 91-11- 26864570;
dstinfo@nic.in; <http://dst.gov.in/>

Coordinates India's institutes of scientific research and support cutting-edge scientific research and has developed water purification technologies for flood affected areas.

Centre for Affordable Water and Sanitation Technology (CAWST), Canada (from [Arshinder Kaur](#), Organic Farming Council, Punjab)

Bay 12, 2916 5th Avenue NE, Calgary, Alberta, T2A 6K4 Canada; Tel: 1-403-243-3285; Fax: 1-403-243- 6199;
cawst@cawst.org; <http://www.cawst.org>

Provides technical training and consulting services and acts as a catalyst to make clean water and sanitation projects a reality for poor people in developing countries, including during disasters

Hindustan Unilever Limited, Mumbai

Hindustan Unilever House, 165/166, Backbay Reclamation, Mumbai 400020 Maharashtra; Tel: 91-22- 39830000; Fax: 91-22-22871970; <http://hul.co.in/brands/water.asp>

Manufacturers many water purification products that can be provided in emergencies.

Development Alternatives, New Delhi (from [Arshinder Kaur](#), Organic Farming Council, Punjab and [M. Manoj Kumar](#))

111/9-Z, Kishangarh, Vasant Kunj, New Delhi 110070; Tel: 91-11-2613-4103; Fax: 91-11-2613-0817;
tara@deval.org; www.deval.org

Promotes sustainable national development and livelihoods and can be contacted for support for water treatment plants for Bihar.

From [M. Manoj Kumar](#), Development Alternatives, New Delhi

DHAN Vayalagam (Tank) Foundation, Madurai

No. 17, Vellai Pillaiyar Koil Street, S. S. Colony, Madurai 625010, Tamil Nadu; Tel: 91-452-2601673; Fax: 91-452-2602247; dhantank@airtelbroadband.in;
http://www.dhan.org/vayalagam/biosand_filters.php; Contact Ms. J. Kanagavalli

Promotes a filter developed by Canadian engineers, which removes most pathogens from water, such as bacteria, protozoa and viruses found in drinking water

Bhabha Atomic Research Centre (BARC), Mumbai

Trombay, Mumbai 400085 Maharashtra; Tel: 91-22-25505050; Fax: 91-22-25505151;
<http://www.barc.ernet.in/webpages/technologies/home.html>

Developed several technologies for purifying drinking water, including removal of arsenic and fluoride

Eureka Forbes, Mumbai

Konkan Nagar Co-operative Housing Society Ltd. Prakash Narayan Kotnis Marg, Mahim (West), Mumbai 400016 Maharashtra; Tel: 91-22-2444-3436; support@eurekaforbes.com; <http://corporate.eurekaforbes.com/>

Manufactures several water purification systems that can be used at the household level.

General Electric, India

<http://www.ge.com/in/news/200611133.html>; Contact Bhavani Giddu; Communications Leader; Tel: 91-9849201322; bhavani.giddu@ge.com

GE and Eureka Forbes have formed a joint venture to manufacture water treatment systems based on GE's reverse osmosis technology.

Subhash Devi Membrane Filters (India) Pvt. Ltd, Mumbai (from [Krishnan S. Raghavan](#), Asian and Pacific Centre for Transfer of Technology (APCTT), New Delhi; [response 2](#))

A-3, Saket, 45/1, Next to Patwardhan Baug, Karve Nagar, Pune 411052 Maharashtra; Tel: 020- 56241874; membranefilters@vsnl.net.in

Manufactures water treatment systems based on a membrane filter developed by the National Chemical Laboratory, Pune

National Environmental Engineering Research Institute (NEERI), Nagpur (from [Prakesh S. Kelkar](#))

Nehru Marg, Nagpur, 440020 Maharashtra; Tel: 91-712-2249885-88; Fax: 91-712-2249900; ra_sohony@neeri.res.in

Developed an instant portable water filter that can be constructed with locally available material and produce enough water for a household to drink every day.

Doshion Limited, Ahmedabad (from [Pramesh Balan](#))

No. 1015, 10th Floor, A-wing, ATMA House, Opposite Old RBI, Ashram Road, Ahmedabad 380009 Gujarat; Tel: 91-79-26574377; Fax: 91-79-26574367; ahmedabad@doshion.com; <http://www.doshion.com/>

Providing water and wastewater management solutions to industry and public since 1977

From [Dipan Shah](#), Society for Environment Protection (SEP), Chennai

Peoples Health and Development Trust, Ahmedabad

Ahmedabad; Tel: 9428503295, 9825455607; Contact Dr. Rajesh Mehta, Secretary

Currently working in Bihar to provide medical facilities, also developed the concept called "Matka Filter" (Pot based Filter) in collaboration with Centre for Environment Education.

Society for Environment Protection (SEP), Ahmedabad

D-2, Keshav Apartment, Memnagar, Ahmedabad 380052 Gujarat; Tel: 079-6513 7987; www.sepindia.org

Multi-disciplinary youth organization based at Ahmedabad (Gujarat, India), working towards inculcating a sense of Environmental Responsibility among citizens.

CARE International, United Kingdom (from [C. Balaji](#))

10-13 Rushworth Street, London, SE1 0RB, United Kingdom; Tel.: 44-0-207-934-9334; Fax: 44-0-207-934 9335; <http://www.careinternational.org.uk/Water+and+sanitation+95.twl>

Involved in the Tsunami Recovery Program of Aceh Province, Indonesia with water and sanitation as a priority, working on suitable sewage disposal and safe sanitation systems

Recommended Contacts and Experts

Mr. Taral Kumar, Akar Impex (P) Ltd., Noida (from [Taral Kumar](#))

Executive Director, Akar Impex; akarimpex@hotmail.com or akarimpex@gmail.com; www.akarimpex.com Has created water purification technologies and can share type of systems that can be boat mounted to enable catering to a flooded area and provide relief. Tel: 09435014166

Knowledgeable on various water purification methods used the state PHED during the recurrent floods

Dr. Abhik Gupta, Reader, Department of Ecology and Environmental Science, Assam University, Silchar (from [Zahir Abbas](#), United Nations Development Programme (UNDP), Silchar)

Tel: 91-3842-270952/270824; abhik.eco@gmail.com

Experience using cost-effective and simple method of solar disinfection of water.

Mr. Eklavya Prasad, Maegh Pyne Abhiyan, Patna (from [Vishwanath Srikanataiah](#), Biome and Argyam, Bangalore)

Maegh Pyne Abhiyan, Patna; Tel: 9973969616

Have done rainwater roof water harvesting in Bihar with support from Arghyam, now in Bihar coordinating flood relief.

Recommended Documentation

From [Vishwanath Srikanataiah](#), Biome and Argyam, Bangalore

UNICEF and Procter and Gamble Join Forces on Safe Drinking Water for Children

Article; United Nations Children's Fund (UNICEF); May 2005

Available at <http://www.medicalnewstoday.com/articles/25044.php>

UNICEF and Procter and Gamble working together to provide safe water to schools, families in emergency situations and reduce exposure to arsenic-contaminated water.

Treating Water at its Point of Use

Article; World Business Council for Sustainable Development

Available at <http://www.wbcsd.org/web/publications/case/png-pur.pdf> (PDF, Size: 100 KB)

Explains a point-of-use (POU) model for treating drinking water, which is has low cost, immediately availability and easy to distribute, including in rural areas and after a disaster.

From [Anshu Sharma](#), SEEDS India, New Delhi

Photocatalytic Destruction of Water Pollutants Using a TiO₂ Film in PET Bottles

Article; by Manuel Heredia and John Duffy; Energy Engineering Program, University of Massachusetts Lowell; University of Massachusetts; USA

Available at <http://energy.caeds.eng.uml.edu/peru-07/173a.pdf> (PDF Size: 50 KB)

Describes how solar disinfection is enhanced in PET bottles coated with a film of TiO₂.

Solar Water Disinfection

Article; Wikipedia; 19 August 2008

Available at http://en.wikipedia.org/wiki/Solar_water_disinfection

Provides an overview of the Solar Disinfection System for drinking water and has links to organizations working in the field.

Household Water Treatment and Safe Storage Following Emergencies and Disasters

Article; World Health Organization (WHO)

Available at http://www.who.int/household_water/resources/emergencies.pdf (PDF, Size: 200 KB)

Discusses ways to purify water at the household level during emergencies, when safe drinking water may not be available

Solar Water Disinfection - A Water Treatment Process Used at Household Level

Pamphlet; eawag and SODIS; Switzerland

Available at <http://www.sodis.ch/files/SODISpamphlete.pdf> (PDF, Size: 356 KB)

Details SODIS how it works, its limitations, its application, development and dissemination as a simple method to improve the quality of drinking water

Solar Water Disinfection- A Guide for Application of SODIS (from [Arshinder Kaur](#), Organic Farming Council of Punjab, Mohali)

Guidelines; SANDEC (Water & Sanitation in Developing Countries) at EAWAG (Swiss Federal Institute for Environmental Science and Technology); Switzerland; October 2002;

Available at <http://www.sodis.ch/files/SODISManualenglish.pdf> (PDF, Size: 5.30 MB)

Reference document for people interested in SODIS, contains information non-technical background and principles for the application of SODIS.

From [Mazhar A Rashidi](#), PRATINIDHI, Lucknow

Point-of-Use Water Disinfection and Zinc Treatment Project

Report; by Pratinidhi; Uttar Pradesh; July 2007

Available at <http://www.solutionexchange-un.net.in/drm/cr/res010908024.pdf> (PDF Size: 103 KB)

Shares progress of the AED/POUZN's Point-of-Use (POU) Pilot Project in Uttar Pradesh, seeks to give conceptual insight into the water purification initiatives under the project

AED/POUZNs Pilot Project in Pictures

Picture Report; Pratinidhi; Uttar Pradesh; July 2007

Available at <http://www.solutionexchange-un.net.in/drm/cr/res010908025.pdf> PDF, Size: 1.14 KB)

Shares pictures of tools used and games carried out under the AED/POUZN's Point-of-Use (POU) Pilot Project in Uttar Pradesh.

Flooding and Communicable Diseases Fact Sheet (from Prakash Kumar, Consultant, SEI-UNICEF, New Delhi, [response 3](#))

Guidelines; World Health Organisation; Switzerland

Available at http://www.who.int/hac/techguidance/ems/flood_cds/en/

The Flooding and communicable diseases fact sheet talks about Risk assessment and preventive measures both short term and long term.

From [J. Prakash](#), KnowledgeLinks, Ghaziabad

Emergency Disinfection of Drinking Water

Guidelines; U.S Environmental Protection Agency; United States of America

Available at www.epa.gov/OGWDW/faq/emerg.html

It provides information about quality of drinking water during emergencies and various disinfection techniques including chlorination, chemical treatment and boiling

How to Use Clorox Bleach for Emergency Water Purification

Guidelines; The Farm; Summertown Tennessee, United States of America

Available at <http://www.thefarm.org/charities/i4at/surv/bleach.htm>

Documents details techniques like boiling and using Clorox bleach for water purification during emergencies

Matka Filter - A Low Cost Filter Concept (from [Dipan Shah](#), Managing Coordinator, Society for Environment Protection (SEP), Chennai)

Article; by Dipan Shah; Society for Environment Protection

Available at <http://www.solutionexchange-un.net.in/drm/cr/res01090801.pdf> (PDF Size: 150 KB)

Pictorial article describes construction of a cheap water filter using a clay pot and a filter candle, which can be used during disaster situations.

Health Preserved by the Purest of Water (from [K. Arup Kumar Patro](#), FOCUS Humanitarian Assistance India, Avaniadda, Andhra Pradesh)

Article; Aquaplus Water Purifiers Pvt Ltd

Available at <http://www.solutionexchange-un.net.in/drm/cr/res01090802.pdf> (PDF Size: 1.8 MB)

Note outlines the range of ultra-filtration systems using hollow-fibre membranes that meet WHO standards for drinking water.

From [Raj Ganguly](#), ACDI VOCA, New Delhi

Moringa Water Treatment

Article; by Beth Doerr; ECHO; USA; 2005

Available at <http://www.solutionexchange-un.net.in/drm/cr/res01090804.PDF> (PDF Size: 80 KB)

Explains how moringa seeds can be used as a natural, free way to purify drinking water and removes suspended solids, and does not require power.

Water Clarification using Moringa Oleifera

Article; by Dishna Schwarz; Gate Information Service; June 2000

Available at <http://www.solutionexchange-un.net.in/drm/cr/res01090805.pdf> (PDF, Size: 142 KB)

Testifies the use of moringa seeds as a natural coagulant for purifying water at household and community water treatment systems

Portable Instand Water Filter (from [Prakash S. Kelkar](#), National Environmental Engineering Research Institute (NEERI), Nagpur)

Brochure; National Environmental Engineering Research Institute (NEERI); Nagpur

Available at <http://www.solutionexchange-un.net.in/drm/cr/res01090806.pdf> (PDF Size: 45 KB)

Describes the NEERI filter, made of local material and can be set up quickly and cheaply, to supply drinking water to households, including during disaster situations.

From [Praveen Kumar Amar](#), Consultant for Disaster Management (Natural & Man Made), New Delhi

Emergency Treatment Of Drinking Water At Point-Of-Use

Article; by Sam Kayaga; Water Engineering and Development Centre; United Kingdom; July 2005 Available at <http://www.who.int/watersanitationhealth/hygiene/envsan/tn05/en/index.html>

Outlines options for quick short-term measures to provide a safe survival level supplies of drinking water from polluted water sources

Water Clarification Using Moringa Oleifera Seed Coagulant

Article; by Geoff Folkard, John Sutherland and Rod Shaw; Water and Environmental Health; London and Loughborough; London

Available at <http://www.lboro.ac.uk/well/resources/technical-briefs/60-water-clarification-using-moringaoleifera-seeds.pdf> (PDF Size: 256 KB)

Overview of the application of the seed Moringa oleifera, as a water purification solution, as opposed to using expensive chemical coagulants

Cleaning and Disinfecting Water Storage Tanks and Tankers

Technical Note; by Sam Godfrey; World Health Organization (WHO); United Kingdom; July 2005 Available at http://www.who.int/water_sanitation_health/hygiene/envsan/tn03/en/index.html

Outlines methods to clean and disinfect water tanks and tankers used for supply of water, and storage, in remote locations, including during disasters.

Rehabilitating Water Treatment Works after an Emergency

Article; by Brian Reed; World Health Organization (WHO); United Kingdom; July 2005 Available at http://www.who.int/water_sanitation_health/emergencies/tn06/en/index.html

Lists the steps for setting up and managing a water supply system following a natural or manmade emergency

How to Measure Chlorine in Residual Water

Article; by Bob Reed; World Health Organization (WHO); United Kingdom; July 2005

Available at <http://www.who.int/watersanitationhealth/hygiene/envsan/chlorineresid.pdf> (PDF Size: 165 KB)

Discusses the problems caused by microorganisms in water and how they can be removed by chlorination.

Cleaning and Disinfecting Boreholes in Emergencies

Article; by Sam Godfrey; World Health Organization (WHO); United Kingdom; July 2005

Available at <http://wedc.lboro.ac.uk/WHOTechnicalNotesforEmergencies/2%20-%20Cleaning%20and%20disinfecting%20boreholes.pdf> (PDF Size: 680 KB)

Gives a 5-step approach to cleaning boreholes after a disaster, so they provide the same quality of water as they did before

Delivering Safe Water by Tanker

Article; by Bob Reed; WEDC; WHO; UK; July 2005

Available at http://www.searo.who.int/LinkFiles/List_of_Guidelines_for_Health_Emergency_Delivering_safe_water.pdf (PDF Size: 780 KB)

Water delivery by tankers is an expensive proposition and requires an elaborate fleet of vehicles, water supply system and provisions to keep the supply chain clean.

Rehabilitating Small-Scale Piped Water Systems

Brief; by Sam Kayaga; World Health Organization (WHO); United Kingdom; July 2005

Available at <http://wedc.lboro.ac.uk/WHOTechnicalNotesforEmergencies/4%20-%20Rehabilitating%20small-scale%20water%20distributions%20systems.pdf> (PDF Size: 632 KB)

Technical brief covers a process of rehabilitating small-scale piped water distribution systems after natural disasters

Minimum Water Quantity Needed For Domestic Use in Emergencies

Article; by Brian Reed; World Health Organization (WHO); United Kingdom; July 2005

Available at <http://wedc.lboro.ac.uk/WHOTechnicalNotesforEmergencies/9%20-%20Minimum%20water%20quantity.pdf> (PDF Size: 517 KB)

Lays out a procedure to determine how much water is needed in habitations during emergencies.

Essential Hygiene Messages in Post Disaster Emergencies

Fact sheet; by Frank Odhiambo; WEDC; WHO; UK; July 2005

Available at http://wedc.lboro.ac.uk/WHO_Technical_Notes_for_Emergencies/10%20-%20Essential%20hygiene%20messages.pdf (PDF Size: 682 KB)

Outlines some of the key activities necessary for dealing with hygiene promotion in post-disaster emergencies

Emergency Treatment of Drinking Water at Point-Of-Use

Technical Note; WHO; Technical Note for Emergencies; No. 5; Switzerland

Available at http://www.who.int/water_sanitation_health/hygiene/envsan/tn05/en/index.html

About simple treatments, suggests quick short-term measures for safe survival level supply of drinking water from unsafe polluted water sources during emergencies

Cleaning and Disinfecting Wells in Emergencies

Technical Note; WHO; Technical Note for Emergencies; No. 1; Switzerland

Available at <http://www.searo.who.int/LinkFiles/ListofGuidelinesforHealthEmergencyCleaninganddisinfectingwells.pdf> (PDF, Size: 875 KB)

Outlines a five stage approach to cleaning and disinfecting wells after natural disasters to rehabilitate them so they produce water of a similar quality pre-disaster

How to Measure Chlorine Residual In Water

Technical Note; WHO; Technical Note for Emergencies; No. 11; Switzerland

Available at <http://wedc.lboro.ac.uk/WHOTechnicalNotesforEmergencies/11-Howtomeasurechlorineresidualinwater/11-Howtomeasurechlorineresidualinwater.php>

Concentrates on the problems caused by drinking water contaminated by micro-organisms as these are by far the most common and can be reduced by chlorination

Rehabilitating Water Treatment Works after an Emergency

Technical Note; World Health Organization (WHO); Technical Note for Emergencies; No. 6; Switzerland Available at <http://www.who.int/watersanitationhealth/emergencies/tn06/en/index.html>

WHO has compiled of list of water treatment technologies, including those appropriate for use during floods

From Krishnan S. Raghavan, Asian and Pacific Centre for Transfer of Technology (APCTT), New Delhi; [response 1](#)

Water Purification Technologies

Information Sheet; by Krishnan S. Raghavan; 2008; New Delhi

Available at <http://www.solutionexchange-un.net.in/drm/cr/res01090803.doc> (DOC, Size: 31 KB)

Provides information on commercially available water purification technologies, along with contact details of the technology providers that can be utilised during disasters

NEERI-ZAR: The New Water Filter for Floods

Article; The Statesman; 20 August 2008

Available at <http://www.idswater.com/water/us/watertreatment/3236/pressreleasecontent.html>

Note on how NEERI developed a water filter to provide potable water during disasters like floods

From [Yusuf Kabir](#), United Nations Children's Fund (UNICEF), Kolkata

Household Water Treatment Options in Developing Countries: Solar Disinfection (SODIS)

Fact sheet; Centre for Disease Control and Prevention and USAID; India; January 2008

Available at <http://www.solutionexchange-un.net.in/drm/cr/res01090826.pdf> (PDF, Size: 130 KB)

Outlines the Solar Disinfection technique and elaborates on the benefits, drawbacks, and appropriateness of the technique.

Household Water Treatment Options in Developing Countries: Flocculant/ Disinfectant Powder

Fact sheet; Centre for Disease Control and Prevention and USAID; India; January 2008

Available at <http://www.solutionexchange-un.net.in/drm/cr/res01090827.pdf> (PDF, Size: 150 KB)

Outlines the water treatment technique using Flocculant/Disinfectant PowderSolar and elaborates on the benefits, drawbacks, and appropriateness of the technique.

Household Water Treatment Options in Developing Countries: Household Chlorination

Fact sheet; Centre for Disease Control and Prevention and USAID; India; January 2008

Available at <http://www.solutionexchange-un.net.in/drm/cr/res01090828.pdf> (PDF, Size: 127 KB)

Outlines the Household Chlorination water treatment technique using and elaborates on the benefits, drawbacks, and appropriateness of the technique.

Household Water Treatment Options in Developing Countries: Ceramic Filtration

Fact sheet; Centre for Disease Control and Prevention and USAID; India; January 2008

Available at <http://www.solutionexchange-un.net.in/drm/cr/res01090829.pdf> (PDF, Size: 150 KB)

Outlines the Household Chlorination water treatment technique using and elaborates on the benefits, drawbacks, and appropriateness of the technique

From [Nitya Jacob](#), Resource Person

Manual on Community Management to Flood Management in India

Book; by Kamta Prasad; The Associated Programme on Flood Management; World Meteorological Organisation; Switzerland; January 2005

Available at <http://www.apfm.info/pdf/pilotprojects/manualindia.pdf> (PDF Size: 1.22 MB)

Explores using a Community Approach to Flood Management, and outlines the results of several pilot studies using this new approach in Bangladesh, India and Nepal.

Putting Technology to Work For India's Poor

Article; by Durga Chandran; Infochange India; August 2005

Available at <http://infochangeindia.org/200509194551/Water-Resources/Stories-of-change/Putting-technology-to-work-for-India-s-poor.html>

Discusses how the National Chemical Laboratory has developed a cheap water filter that has immense potential in disaster-struck areas.

Recommended Portals and Information Bases

Solar Water Disinfection, Swiss Federal Institute of Aquatic Science and Technology (from [Vishwanath Srikanataiah](#), Biome and Argyam, Bangalore)

<http://www.sodis.ch/>; Contact Ms; Regula Meierhofer; Head of the SODIS Reference Center; regula.meierhofer@eawag.ch

Site contains information on improving microbiological quality of drinking water, using solar UV-A radiation and temperature to inactivate pathogens causing diarrhoeaea

Related Consolidated Replies

Management of Water and Sanitation during Disasters, from V. R. Raghavan, Oxfam GB, Kolkata (Experiences). Disaster Management Community and Water Community. Issued 13 June 2007 Available at www.solutionexchange-un.net.in/drm/cr-public/cr-se-drm-wes-15050701-public.pdf (PDF, Size: 169 KB)

Explores solutions and experiences to sustain and manage water sources, mechanisms for excreta disposal, the issue of WATSAN and public health and hygiene during disasters

Responses in Full

[Somnath Basu](#), United Nations Children's Fund (UNICEF), Guwahati (response 1)

Kindly refer to the water purification methodology pursued by Public Health Engineering Department, Government of Assam during floods.

They use a sachet containing Ferric Alum (approximately 64 mgs), Lime (approximately 32mgs) and Bleaching Powder (approximately 4 mgs). The volume of the sachet is 100gms. The sachet can purify approximately 20 liters of turbid water. Ferric Alum and lime & bleaching powder should not come in

contact with one another inside the sachet, i.e., the sachet will contain Ferric Alum and another small packets containing lime and bleaching powder separately.

The Ferric Alum and Lime should be made available in powder form. Hence if you plan to distribute these sachets to the affected areas, if have to arrange for space in advance where Ferric Alum and Lime can be grinded.

If water is not turbid then NaDCC tablets (33mg) can be used. Each tablet will purify approximately 20 liters of water.

For further information contact Mr. Abhijit Dutta, Chief Engineer (Sanitation), Public Health Engineering Department, Government of Assam, Cell Ph: 09435014166.

Hope this helps.

Pooja Saxena, International Federation for Red Cross and Red Crescent Societies, New Delhi

The Indian Red Cross Society owns 13 portable water treatment plants of different capacities and has been deploying these units in event of disaster like in Tsunami, floods in 2006 and 2007 and in Jammu and Kashmir earthquake.

Some of these water treatment plants are capable of purifying a 100,000 litres of water per day, but some of these are under repair at the moment but three of these are being deployed in Bihar.

Atal Behari Sharma, Camp: Simrahi, Supaual (response 1)

Yes, Drinking water and Sanitation is an urgent need, while choosing any technology kindly keep ground realities in mind.

Still the fastest and easiest way is to provide drinking water is to sink hand pumps in adequate number. With large scale displacement land/space for relief camps are the critical issue. To keep hygienic condition in camps we need adequate space to at least accommodate 15 lakh people from minimum 3-4 months in camps.

K. A. Benny, CARE India, Tamil Nadu

Its really challenging in flood inundated districts of Bihar to provide health and hygiene. I believe not only water but health and sanitation should be also looked after following the floods. Because of lack of potable water there may be high risk of diarrhea and water borne diseases. We should be well prepared to tackle those situations.

In the mean while, in the Tsunami hit villages of Kanyakumari, I know that WATER AID has provided lot of potable drinking water sources and sanitation measures. If you could, please contact them or else I will try to establish some linkage. This is for your information.

Zahir Abbas, United Nations Development Programme (UNDP), Silchar

Presently, I am working for National Rural Health Mission, Assam. I had worked for CDBP Programme for 3 years and gained a lot of experience in coping or living with floods. The following are some of the methods which I learnt from an eminent environmentalist of Assam, Dr. Abhik Gupta, Reader, Dept. of Ecology, Assam University.

- According to Dr. Gupta, a 1 litre cleaned plastic water bottle filled with river water or tap water if kept in the sun for 7/8 hours in 45 degree angle, the water can be consumed. The sun rays can kill many of the germs and it makes the water safe to drink.
- In Bangladesh, there is a local method of purifying the water. It is called "Saree method". Take a normal length saree and give it 8 folds and than keep it on the top of a vessel and pour the water. The saree stops many of the sands, tiny creatures to fall in the vessel. The water in the vessel can be consumed.

Arshinder Kaur, Organic Farming Council of Punjab, Mohali

It is indeed a grave problem in Bihar at this time and all of us as Citizens must gear up our faculties to do as much as possible in our prevailing situation. In the existing situation, I can suggest you of Development Alternatives of

This organisation has given training to several master trainers to develop bios and filters with a Canadian Based development organisation, namely CAWST, their Director being Ms. Shauna Curry, I believe that the training conducted by the DA in their Orchha office, near Jhansi should be in its stage of replication now. The bios and filters can be developed from Local resources, done together by the affected masses and are very economical and useful in the long run. The website address of the Canadian agency is www.cawst.org.

Vishwanath Srikanataiah, Biome and Argyam, Bangalore

Please try to get the Procter and Gamble product called PUR
<http://www.medicalnewstoday.com/articles/25044.php> and
<http://www.wbcds.org/web/publications/case/png-pur.pdf>.

It comes in a sachet and does the job of coagulation and turbidity removal and disinfection simultaneously.

On a long term SODIS (www.sodis.ch) would be good. Chlorine/halogen tablets are of course usually used.

For contacts Eklavya Prasad from Maegh Pyne Abhiyaan - a partner NGO of Arghyam - is in Patna and coordinating much of the efforts there. His mobile number is 9973969616.

Sunil Uplap, Tanclean Pvt. Ltd., Thane

Thank you very much Mr. Basu for this resourceful information. Please let me know the source of getting NaDCC tablets in India, we would like to procure them and have them sent to Bihar through our Disaster Relief Rotarian Action Group, of Rotary International, Dist. 3140.

Looking forward to receive this information as soon as possible.

Somnath Basu, United Nations Children's Fund (UNICEF), Assam (response 2)

Please find below the information:

Water Chem Laboratories
11-6-652/1
1st Floor, Red Hills, Hyderabad 500 004
Factory:
156/D, Industrial Estate, Kattedan, Hyderabad 500 277

E. Mohamed Rafique, UNAIDS India, New Delhi

I would like to state three methods of chlorination that we used where I worked earlier in the remote hills of Kerala, especially in times of disasters.

Shock Chlorination: This is a one-time addition of chlorine powder, bleach or liquid bleach to the water body. It is done by adding 5-10 mg/liter to the water in a well and allowing it to remain unused for a period of a few hours. The first water drawn from the well after the disinfection period is discarded and normal use is subsequently resumed. When a well is charged from safe ground water, but has been contaminated by an unusual event such as flooding, dead animals, or human excreta, then shock chlorination can eliminate such a transient threat to water quality. Shock chlorination does not provide for continuous supply of chlorinated water to the people in their homes, because after the first few hours of use after treatment, little or no residual chlorine will remain in the water drawn from the well. Removal of Solid waste is recommended before shock chlorination.

Pot chlorination: A chlorination pot includes a small container, such as a two-liter Plastic mineral water bottle with a few holes punched in it. This container is filled with bleach (chlorine powder) and gravel mixture and placed inside a larger vessel, such as a four or eight liter plastic bucket or mud pot. The larger vessel also has holes punched in it. The chlorine disperses from the double layered pot slowly. The number and size of the holes in the vessels controls the disinfectant dose and must be tailored to match a specific well, tank or water body volume and the withdrawal or run off rate from this water source. Invariably the first water drawn in the morning will have a high level of chlorine, some times odorous enough to remind you it is working! Conversely, during the hours of high usage, the chlorine dose may become low.

Drip Chlorination: This is a method we devised from the principle of the hospital intravenous drip set. We used it in the hills where the water body to be chlorinated has a continuous flow like a running stream. A small check dam or bund diverts water through a pipe to a tank which has a provision for overflow, when there is no usage. Liquid Chlorine is filled in the plastic bottle from which the drip of chlorine can be regulated by a squeeze valve, on its outlet. The needle from which the liquid chlorine drips is kept well submerged in the tank by a suitable anchor. Wastage of chlorine during times of low usage is a disadvantage. In our experience, regular supervision and change of the bottles every day was a setback. Devising larger equipment was also difficult. Hence the tanks had to be small and the number of houses supplied less. The cost of chlorine consumed is highest in this model.

Anshu Sharma, SEEDS India, New Delhi

While technologies are being explored and promoted for this critical issue of water purification, we may also look at SODIS (solar disinfection).

Solar disinfection is a virtually no-cost process of putting the available contaminated water in closed PET bottles (which can be found in abundance in the recycling and solid waste sector), and exposing it to sunlight for a few hours. Bottles can be kept on rooftops, and can even be partly painted black to increase heat gain. If cloudy conditions prevail, the exposure time can be increased. The process works on heat as well as ultra-violet radiation gain.

SODIS information can be found on the website www.sodis.ch. A detailed pamphlet can be downloaded from www.sodis.ch/files/SODISpamphlete.pdf

General information is available on Wiki at the link <http://en.wikipedia.org/wiki/Solarwaterdisinfection>

It has also been recognised by the WHO for use in emergencies. Refer to the following link http://www.who.int/household_water/resources/emergencies.pdf

There have been past efforts on promoting SODIS in India, including a national workshop in Delhi chaired by S&T Minister Mr. Kapil Sibal. However, the technology has not really been used at any significant level that I know of.

It must of course be promoted with the relevant disclaimers. Solar disinfection will not remove chemical contaminants. It may not be fully effective in turbid water, and such water may need to be filtered before solar exposure. If conditions are cloudy, exposure of about two days may be required. While the technique itself is almost zero-cost, it does need investment in education for its promotion.

Technical information on photocatalytic destruction of water pollutants (solar disinfection of water!) based on field tests conducted by the University of Massachusetts in Peru is available at <http://energy.caeds.eng.uml.edu/peru-07/173a.pdf>

Abhishek Mendiratta, Consultant, New Delhi

The disinfection of water is most important during floods which can be done by using halogen/chlorine tablets at household level and bleaching powder is used at source. The residual chlorine in water after the disinfection can be checked with the chloroscope.

The following supplies should be arranged:-

- Provision of water purification sachets.
- Water quality monitoring using H₂S strip vials and chloroscopes
- Provision of soap for hand washing
- ORS packets for management of diarrhoea
- IEC for prevention and management of diarrhoea

There are many organizations working in the area of disaster management. The people/organization that can contribute at this time are as follows:-

- Mr. S. N. Singh, WES officer, UNICEF, 8 Patliputra Colony Patna
 - Sulabh International, Gandhi Maidan, Patna
 - CARE, Patna
-

Dipan Shah, Society for Environment Protection (SEP), Chennai

During Gujarat flood we had developed along with People's Health and Development Trust (PHDT) a low cost concept called "Matka Filter" (Pot based Filter). In the same what we had done was to fix a normal filtration candle in the earthen pot. A common candle of this kind cost about Rs. 50 to 75 per piece and the whole assembly shall cost not more than Rs. 100 to Rs. 150.

It can be distributed widely on one per family basis. Normal water could be boiled and then introduced into this pot. The making of this filter can also be explored as livelihood activity in itself. For reference of all, am sharing few snaps of this filter. Please refer to the link: <http://www.solutionexchangeun.net.in/drm/cr/res01090801.pdf>. (Size: 165 KB)

If any further information is needed on the same do contact us at dipan@sepindia.org.

K. Arup Kumar Patro, FOCUS Humanitarian Assistance India, Avanigadda, Andhra Pradesh

Aga Khan Development (AKDN) is working in Tsunami hit as well as geographically vulnerable villages of Nagaylank Mandal of Andhra Pradesh. The concept of the project is such that it links the interventions from Disaster Relief to Development. The aim of the program achieved the following four objectives:

- Increased the capacity of the community and their institutions to cope with disaster;
- Reduced the vulnerability to health and hygiene risks through improved access to sanitation and other support services;
- Established linkages for information dissemination and best practices by setting up a Coastal Resource Center (CRC), and
- Enhanced gender equality through capacity building and involvement in planning and implementation of activities.

History confirms that the entire East Coast is the one of the most vulnerable areas of the country frequently battered by cyclones. In addition, during each and every season, a substantial stretch of land is submerged by flash flood waters. This significantly multiplies the vulnerability on the population. As you know during disasters, availability of fresh water is a major challenge. This is universal problem.

For address this issue AKDN supply emergency water treatment Hollow Fiber Ultra Filtration Membranes Technology in all operational village in village stock pile as well as in regional stock pile. It can purify surface water during or post disaster community can use this system very easily. These instruments have good facility it can work with out power. This instrument is users friendly also. Here I am sharing the brochure of the system. To read please click: <http://www.solutionexchangeun.net.in/drm/cr/res01090802.pdf> (Size: 1,777 KB)

For further clarification you my contact: Mr. Rahul Pathak, Head-CSR & Disaster Management Cell, Aquaplus P LTD, www.aquaplusltd.com. Hope this helps you.

Hitesh Chakravorty, District Elementary Education Office, Hailakandi, Assam

I am residing in Assam, Barak Velly region, the region is chronically flood affected. For the flood affected people a water purification packet was supplied. The packet consist mixture of 60gram of Alum, 30gram of Lime and 10gram of Bleaching powder in separate packet. To purify one bucket of water 18 to 20 liter taking one tea spoon of the mixture (alum &lime), steer the water with clean ladle after settling down the suspended particle, clean water taking out from the bucket using clean cloth in a separate bucket.

Then taking one tea spoon of Bleaching powder in a cup full of clean water then taking one or two tea spoon of bleaching water then add in the clean water bucket it is safe for drinking This may be try to solving the drinking water problem for the flood effected people.

Abhishek Singh, United Nations Children's Fund (UNICEF), Patna

We had explored while working In Bihar Floods 2004 in Madhubani district we had explored the possibilities of Mobile Water treatment units. We came to know that ION Exchange is preparing this type of Unit. The Mobile unit can be mounted on Boat also. I am just giving the information as we faced the crunch in 2004.

INDION mobile Disaster Management Unit (DMU) for drinking water treatment was developed to meet the critical

need for safe drinking water during disasters such as droughts, cyclones, floods and earthquakes. During such times water supplies get contaminated with suspended solids, dirt, clay and pathogenic bacteria, spreading disease and epidemics. Besides, the water could also contain heavy metals and chemicals, due to pollution. The DMU can treat any kind and quality of surface or high salinity

ground water to produce drinking water conforming to stringent IS 10500 standards; it can also treat chemically contaminated water. The unit consists of membrane processes and ozonation modules which can be used in combination, depending on the quality of water to be treated. Moreover, treatment plants specifically for removal of iron, arsenic, nitrates or fluoride can be added on when these contaminants are present in ground water supplies.

The DMU is compact, containerised and skidmounted; it can be mounted on a truck and quickly transported to affected areas. As it can work on a diesel generator, it can be operated in areas where electricity supplies have been disrupted or in remote villages which do not have electricity. Apart from natural disaster situations, the DMU can also be used in places which do not have drinking water facilities, by the armed forces during peacetime military exercises in remote areas, and during warfare. DMUs have been supplied to Public Health Engineering Departments (PHEDs) of various states. Two DMUs, each of 1 m³/h capacity, one for Barassat division and the other for Malda division, were supplied to West Bengal PHED. The skid-based, truck mounted DMUs incorporate membrane and ozonation technologies for disinfection, as well as iron and arsenic removal units. A 2 m³/h DMU with ultrafiltration, ozonation and iron removal has been supplied to Meghalaya PHED.

For details contact Ion Exchange (India) Ltd., Hocro@ionexchange.co.in or ho.commun@ionexchange.co.in
Website: www.ionindia.com

Muhammad Iqbal, Bio-Envoir Private Ltd., Singapore

It is indeed a pity that India is being hit by calamities regularly and so sees so much of suffering and diseases.

I refer to the several messages received from the community for the alleviation of the misery for the provision of Clean Drinking Water in Bihar where the floods have come and this scenario is possibly going to be repeated in a couple of months elsewhere in INDIA as has been cases in the past and there is no sense of direction of Mother Nature where it would create Havoc next.

The easiest solution for all NGO's and other organizations involved in relief work in INDIA is to purchase and keep ready the Water Filter that is being marketed through us.

- It is portable, which means you can move it to any location any time
- It filters and produces 1500 Litres of water every hour with continuous operation 24/7 no stoppage needed.
- It does not need any power or machinery to operate
- It does need any chemicals or purificants to clean the water
- It uses micro filters and is guaranteed to remove all bacteria and viruses
- It can be used continuously for 3 years without having to replace the filters
- It reduces diseases, sicknesses and all the ailments associated with water borne diseases

This is a product that is produced in Singapore and is guaranteed by the Manufacturers to work and has worked successfully by all those who have purchased units immediately from the Tsunami Days.

We call it the Pedal Gen. This can be used with and without the Cycle.

This alleviates the problem immediately as it can commence filtering water from ponds, water logged areas and delivers water immediately.

Subsequently after use, it can be stored and kept standby for as long you want it to.

I would appreciate in receiving your feed back and in case you need it we can mobilize it immediately.

Manish Kumar, Technology Information Forecasting and Assessment Council (TIFAC). New Delhi

The issue of providing drinking water is urgent in such a adverse condition. I would like to share, in such a critical condition, we need any potable/handy and electricity free water purification system which can provide the water for drinking purpose.

In this context, I remember, the technology (Purion-name of technology) developed by National Chemical Laboratory, Pune which is membrane based. This was developed by NCL Pune and supported by Department of Science and Technology. The unique features of this unit is: it is completely manual requires no energy and provides water free from biological contamination. In flood like condition, the main focus should be given on to provide microbial free water without too much botheration on removal of chemical contaminants to avoid any epidemic like situation. I had tested the efficacy of this water purification kit when i was in IIT Delhi and found very suitable for rural use where electricity is not available and river water is the only source of drinking water.

I strongly recommend that Bihar government should procure the above water purification kit (in large number) on request from NCL, Pune or Department of Science and Technology under the relief materials. This will definitely prove as a boon for peoples affected by flood which is not a normal but man-made calamity due to sheer negligence of state authority. For more detail please contact NCL Pune or DST.

Somnath Basu, United Nations Children's Fund (UNICEF), Assam (response 3)

In case you are dealing with diarrhoeal outbreaks you may use Calcium Hypochlorite (65% - 70% active Cl) both for water purification and also Hospital Management (having diarrhea patients).

You need to prepare a stock solution (mix 15 grams, i.e., 1 level Table spoon or 3 level Tea spoons of Calcium Hypochlorite - 70% in 1 liter of water). This stock solution will last for about 1 month. For water purification you need to mix 0.6 ml or 3 drops of the solution in 1 liter of raw water.

For hospital/ health camp management Calcium Hypochlorite is a very effective item. Please contact Emergency Section in UNICEF for more information.

Johnson Rhenius Jeyaseelan , WaterAid India, Bhopal

WaterAid India launched disaster preparedness in flood in Bihar in 5 districts before the floods. Under the programme water filters were given to the project villages. I think that water filters can be given to all relief centres to get purified water. The water filters of Hindustan Unilever costs around Rs. 1800.

Please do contact Mr. Shailesh, HUL, Mumbai in his mobile at 9820307088. They helped us to provide filters in the districts where we worked.

Premesh Balan, Doshion Limited, Ahmedabad

We are involved in water treatment business since last 30 years.

We have a specialized division to cater to rural drinking water. We would be glad to offer our services and expertise to the Government of Bihar and other NGOs working on relief and rehabilitation activities.

For further details, you can reach us at pbalan@doshion.com and cell no. 09327585820.

M. Jahangir, Drinking Water-Pakistan, Islamabad

Flood area has water containing silt. I propose the following

- Common biosand technique, with a little pretreatment of Pot: Al Sulphate (Phatkry) and settling time, before feeding to the sand filter. In Pakistan people are trying this method in earthen long pitcher, called Nadi in Sindh, Pakistan. If you need more information that can be supplied.
- Pasturised water in plastic pouch can be another viable alternative, because it eliminates the cost of bottle and costly RO.

Anurag Mishra, Academy for Educational Development (AED), Lucknow

We have been implementing a safe drinking water project in parts of rural UP imparting knowledge as well as different POU products. We are basically guiding on

Boiling water--

- a) SODIS-- or Solar Disinfection
- b) Chlorination-- We are promoting Sodium Hypochlorite solutions and Chlorine tablets
- c) Low cost water purifiers

I would suggest that for Bihar flood area the option of using Sodium hypochloride solution which is a CDC approved product and is a social marketing product by PSI. The product is in form of liquid and packed in small plastic bottle. A bottle is sufficient enough to purify about 1000ltrs of water. Although it can not remove physical impurities but can help in averting microbial contamination. The product cost about 10Rs to a hh and can easily last for 1.5 to 2 months. We have seen the same being taken up by rural communities in very positive ways. I believe the same could also be used in flood prone area of Bihar.

Prakash Kumar, SEI-United Nations Children's Fund (UNICEF), New Delhi

We need immediate solution for the stranded people in camps. To start with packaged water should be distributed immediately in plastic sachet of 250 ml for drinking purposes from a nearby district which is not affected from flood and also advise for solar disinfection and boil water before drinking.

Later on bleaching powder, chlorine tablet, ceramic filter etc should be distributed for purification of water when somehow they stabilized in the temporary shelter.

M. Manoj Kumar, Development Alternatives, New Delhi

There are various low cost, water purification methods available (bacterial removal) presently (particularly in the emergency situations like the current Bihar-Floods). Some of them are:

- SODIS-Solar Water Disinfection through UV radiation, if PET bottles (bottles need to be cleaned, bottles are to be of food grade should not leach while heating through sun) kept under sun for 6 hours, will kill the pathogenic bacteria and provides pathogen free water. Normal Water bottle can also be used in this case.
- Sand filtration technique: Age old/traditional technique can be used to arrest the pathogens, very effective in these situations.
- Ceramic filters: Most of the people in remote areas under various programmes are using these filters

Apart from the above there are other methods through one can purify water. Of course Chlorination is the immediate one. one can use Hypochloride, Bleaching powder, etc. The percentage of available chlorine would vary in each case. The actual doses need to be calculated based on the requirement.

Apart from the above, if we are looking at Physical and Chemical, then following purification systems/approaches can be explored:

Arsenic (Bihar has been reported as one of the arsenic hit area). Household arsenic removal filters can be explored, Rain water harvesting (most of the chemical parameters are removed in this process- evaporation and condensation if it is currently raining), but one has to test the quality of the water before consumption as it may contain lot of impurities). It is therefore advised that before drinking water, quality needs to be checked properly.

Turbidity: Slow Sand Filter, Ferric Alum, Drum Stick's seeds, etc.

I can imagine at this point of time the main problem is/will be Microbiological organisms (Bacterial Contamination) in the drinking water. Therefore any one of the practically possible water quality purification methods like SODIS, Chlorination, SARI method(as mentioned by Mr. Zahir Abbas), Slow Sand Filtration-Biosand Filtration technique, Ceramic Filters, etc. can be utilised. We can not go for large scale installations in the current situation. There are mobile water purification systems also available.

Few organizations with whom one can interact.

- DHAN Foundation, Madurai-Biosand Filter
- RRL-Bhubaneswar-Ceramic Filters
- BARC-Variou technologies
- Membrane Filtres-Pune
- Eureka Forbes
- GE

- P & G
- PHILIPS
- Developemnet Alternatives, Delhi- Biosand Filters, Arsenic, Fluoride, etc

I will be glad to respond incase there is a need.

Rajesh Gopal, Gujarat State AIDS Control Society (GSACS), Ahmedabad

Paucity of potable water with 'water water everywhere' is a huge problem in such a scenario.

We should, however, try to advocate and promote foolproof ways of ensuring availability of safe water through easier and proven methodology like chlorination any feasible heat treatment/boiling lest there should be a rise of gastroenteritis, hepatitis and what have you even before the recession of the water line.

It is quite challenging during such a gigantic problem being faced in Bihar and Jharkhand (as we saw at the time of Surat floods) but we should try for that only with strengthened efforts through mobilization of more and more resources-financial, human or otherwise.

R. K. Rao, Samata, Hyderabad (response 1)

P&G markets 'PUR' water purifying mixture in sachets through its social marketing unit-peoples services international;each sachet is sufficient to treat 10 liters of turbid water; you can find more details by visiting the web address given here: <http://www.psi.org/ourprograms/products/pur.html>. Ravishwar Sinha, Independent Consultant, New Delhi

deactivates all pathogens-viruses, bacteria, protozoans-99.9%. Although it is not marketed in INDIA,PSI can get it from Pakistan where it is manufactured for world supply.

PSI markets in India SAFEWAT, a dilute solution of bleching powder in 100ml bottles for Rs.10/;safwat is not effective against turbidity nor does it deactivate protozoans; so go for PUR and it costs around ten cents[around Rs.5/ per sachet].

Krishnan S. Raghavan, Asian and Pacific Centre for Transfer of Technology (APCTT), New Delhi (response 1)

Asian and Pacific Centre for Transfer of Technology (APCTT) based in New Delhi is a regional institution of the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) based in Bangkok. APCTT's mission is to promote technology transfer and capacity building of SMEs and business firms in the Asia-Pacific region. As part of its technology information services, APCTT has designed a website called as www.technology4sme.net to facilitate information sharing and networking of technology based business firms across the Asia-Pacific region and beyond.

Disaster Management and Mitigation is one of the key focus areas of www.technology4sme.net and there is a Disaster Management and Mitigation database that provides information on technologies that helps in the disaster management and mitigation initiatives. With regards to the need of Water Purification Technologies that are useful in disaster management situations, especially in the present context of Bihar situation, please refer to a brief information note on Water Purification Technologies that are commercially available, along with the contact details of the technology providers.

To read the note click: <http://www.solutionexchange-un.net.in/drm/cr/res01090803.doc>. For more information on the technologies mentioned in the document, please visit the Technology Offers section of www.technology4sme.net and refer to the technologies under Disaster Management and Mitigation.

I hope, this information may be of help to the cluster members who are actively involved in the disaster management initiatives in Bihar. Please feel free to contact me, if you need any further information and/or assistance.

Raj Ganguly, ACDI VOCA, New Delhi

Moringa seeds are a cheap source for purifying water. Please read the reference articles here: <http://www.solutionexchange-un.net.in/drm/cr/res01090804.pdf> and <http://www.solutionexchangeun.net.in/drm/cr/res01090805.pdf>.

I believe NGOs/Organisations in South India can take lead to supply this to Bihar. Even wider dissemination of this information also will help the locals.

Prakash S. Kelkar, National Environmental Engineering Research Institute (NEERI), Nagpur

This has reference to your email dated September 1, 2008 in connection with the above subject.

NEERI has developed Portable Instant Water Filter "NEERI-ZAR", the water purification system for rapid treatment of safe potable water supply under emergency situations like floods, heavy rainfall, or cyclones when the villages are not approachable, have no electric supply and do not have potable water to drink. The unit is easy to fabricate and simple to operate and maintain having low capital cost. It provides the onsite treatment to available flood water under emergency situations to remove the organic contamination, suspended solids and bacterial load to produce safe potable water within few hours using the locally available material and without using electric power supply. Ravishwar Sinha, Independent Consultant, New Delhi

Usefulness of NEERI-ZAR water filter was proved during the floods in the Barmer district of Rajasthan. NEERI had installed 100 units in the flood affected remote areas of Barmer District in October 2006 to convert the turbid and contaminated rainwater into potable water. Performance of these units under field conditions was evaluated and the opinion of the local people was recorded. People using treated water from these units were very happy with the quality of water produced by NEERI-ZAR units. They expressed their gratitude for timely help provided by NEERI team for the supply of potable water at the time when all their water sources were either destroyed or contaminated due to flood; even tanker water supply was not available due to non approachability of the villages.

Recently team of NEERI scientists was awarded the Nina Saxena Excellence in Technology Award 2008 instituted by IIT Kharagpur for development of NEERI-ZAR. A patent has been filed titled Portable Instant Water Filter on Jan. 29, 2007 Ref. No. 0268NF2006/IN.

We are providing the design of this unit for social cause with a request to protect the IPR. Refer to the design here: <http://www.solutionexchange-un.net.in/drm/cr/res01090806.pdf>. The IPR modalities will be worked out as per CSIR Guidelines. It is also requested to put the CSIR Emblem on all the NEERI-ZAR units that will be installed at the flood affected areas of the Bihar state.

R. K. Rao, Samata, Hyderabad (response 2)

If PUR may take time to get, you can remove turbidity by use of Alum (aluminum sulphate) or drumstick seed powder or chilla (*strychnos potatorum*) seed to remove turbidity;

Solar water disinfection

In solar water disinfection, (SODIS <http://en.wikipedia.org/wiki/SODIS>) microbes are destroyed by temperature and UVA (<http://en.wikipedia.org/wiki/Ultraviolet#Explanation>) radiation provided by the sun (<http://en.wikipedia.org/wiki/Sun>). Water is placed in a transparent plastic bottle, which is oxygenated by shaking. It is placed for six hours in full sun, which raises the temperature and gives an extended dose of solar radiation, killing some microbes that may be present. (Wikipedia)

If the water filled bottles are wrapped in black polythene (black garbage bags can be used) it gets hot fast; studies have shown that water need not be boiled, if it reaches 65 degrees centigrade all pathogens will be deactivated; the advantage of this method is that water does not have smell and locally can be made safe. But some effort is needed.

C. Balaji, CARE, New Delhi

CARE India has been gifted a water purifying machine by the GE company last year during the last year floods in Bihar. The machine had the capacity to purify about 1200-1500 liters of water every hours. However the capacity to filter water came down by about 20% after a few weeks as the filters were clogged.

We had mounted the filter machine on the auto rickshaw type of vehicle and took it around village by village (about 20 villages) and served the needs of about 10,000 families. The water was very well accepted and the communities reported no water born infection during this period.

We are also trying to put in to use the same technology and machine during these floods. Shall keep you informed about the outputs.

Ravishwar Sinha, Independent Consultant, New Delhi

Thank you for bringing to focus this very important topic, as the Bihar disaster goes more into recovery and rehabilitation mode the populace would be in safe places where chlorination and hand pumps would be made available if not already available .

Rescue/Recovery phase

A good part of the population are still stranded, however the Government feels that in the next two days all the people will be in safe places. This apart from shelter and assured food would facilitate the provision of safe water and other health and hygiene support. We need to save the people who have been rescued from falling prey to disease. The women and children need special focus and support.

All those who are doing this great work, be they be from civil society, NGO , Government, armed forces and the leadership at all levels deserve thanks and encouragement for their efforts in the difficult situation.

The various methods that have been described by our colleagues are all very standard and doable. I fully endorse them.

Chlorination of water and boiling and drinking it after cooling it are still the most useful methods practiced. In the camps there should be full and adequate chlorination of water sources and disinfection of sewage and proper disposal of waste .Hand pumps are being installed in the camps along with latrines and medical camps.

The Government is providing food packets of sattu, rice and churra, which require water for preparation and digestion. Could the Government also not be able to give purified water packets. A bar of soap if also given along with in the food droppings could greatly facilitate hygiene. I believe chlorine tablets are also being reached in very large numbers..

In Bihar floods last year the drinking straw was also appreciated. This is handy and requires some suction efforts but does make the turbid water drinkable. UNICEF, Patna had taken a commendable lead last time in their distribution. They have been very successful in other parts of the world also.

Communication efforts to show the do ability of the pure water and hygiene methods should and am sure is already a priority in the camps.

Eating fresh prepared food and drinking boiled cooled water with clean hands and utensils should be an important message.

In the rehabilitation phase, community awareness for safe water and hygiene practice should be a enhanced priority.

Rehabilitation, analysis and preparation phase

Unfortunately the recurrence of floods is an eventuality that North Bihar lives with. A lot of efforts are being made but for the immediate future it is a reality. The Disaster management training that has been on going and the plans to meet them should be more situation responsive. Safe water availability technologies should be a synergistic part of the health, education and nutrition package that is being putting in the recovery and rehabilitation efforts in this national calamity should give more priority to availability and need for water and hygiene. Community ownership and leadership need to be encouraged.

These would also have a big spin-off in better health, nutrition and hygiene seeking behaviors with positive impact on community welfare. Thanks to all doing this great humanitarian effort

Praveen Kumar Amar, Consultant on Disaster Management (Natural & Man Made), New Delhi
(response 1)

I appreciate your endeavors in seeking and providing relief to the people of Bihar in your right earnest.

In addition to the various RO and charcoal based filtration and purification technologies that may eventually reach you/ them, I wish the traditional methods can fill the gap in emergencies:

- Cotton Saree:
 - Water when passed/ filtered through six folds of a cotton saree is generally regarded as safe enough for drinking in emergencies.
- UV light
 - Green glass bottles when filled with water, exposed to sunlight for 8-10 hrs, kept overnight will be fit for consumption the next morning in emergencies.
- Fuel Wood ash
 - Finely ground fuel wooden ash in the proportion of 96 gms to 11 liters of water, stirred, kept for two hours and then filtered can be safe water for consumption in emergencies.
- Drumstick seeds powder
 - Moringa Oleifera Refer to the technical note of WEDC-WHO is for procedure here: <http://www.solutionexchange-un.net.in/drm/cr/res01090807.pdf> and for Guidance click: <http://www.solutionexchange-un.net.in/drm/cr/res01090808.pdf>
- Household Water Treatment and Safe Storage Following Emergencies and Disasters - WHO
 - South Asia Earthquake and Tsunami. Refer to the document: <http://www.solutionexchange-un.net.in/drm/cr/res01090808.pdf>
- Emergency Treatment Of Drinking Water At Point-Of-Use
 - WEDC-WHO; <http://www.solutionexchange-un.net.in/drm/cr/res01090807.pdf>

Also refer to relevant WEDC - WHO technical notes for your needful please.

- Cleaning And Disinfecting Water Storage Tanks & Tankers (<http://www.solutionexchangeun.net.in/drm/cr/res01090810.pdf>)
- Rehabilitating Water Treatment Works After An Emergency (<http://www.solutionexchangeun.net.in/drm/cr/res01090811.pdf>)
- How To Measure Chlorine Residual In Water (<http://www.solutionexchangeun.net.in/drm/cr/res01090812.pdf>)
- Cleaning And Disinfecting Wells In Emergencies (<http://www.solutionexchangeun.net.in/drm/cr/res01090813.pdf>)
- Cleaning And Disinfecting Boreholes In Emergencies (<http://www.solutionexchangeun.net.in/drm/cr/res01090814.pdf>)
- Delivering Safe Water By Tanker (<http://www.solutionexchange-un.net.in/drm/cr/res01090815.pdf>)
- Rehabilitating Small-Scale Piped Water Distribution Systems (<http://www.solutionexchangeun.net.in/drm/cr/res01090816.pdf>)
- Minimum Quantity Needed For Domestic Use In Emergencies (<http://www.solutionexchange-un.net.in/drm/cr/res01090817.pdf>)
- Essential Hygiene Messages In Post-Disaster Emergencies (<http://www.solutionexchangeun.net.in/drm/cr/res01090818.pdf>)
- How To Measure Chlorine Residual In Water (<http://www.solutionexchangeun.net.in/drm/cr/res01090819.pdf>)
- Rehabilitating Water Treatment Works After An Emergency (<http://www.solutionexchangeun.net.in/drm/cr/res01090820.pdf>)
- Cleaning and disinfecting water storage tanks and tankers. ([Http://www.solutionexchangeun.net.in/drm/cr/res01090820.pdf](http://www.solutionexchangeun.net.in/drm/cr/res01090820.pdf))

Alinawaz, Focus Humanitarian Assistance India, Bhavnagar, Gujarat

The situation in Bihar is a big challenge as far as water and sanitation is concerned. The best solution for this is to install RO water Purification plant which runs without Electricity. There are chances that if people consume contaminated water there is fear of outbreak of epidemics and water born diseases. Thus it is advisable to use RO water purification plant in Bihar for time being.

S. Khuntia, Institute of Minerals and Material Technology, Bhubaneswar (response 1)

We have developed TERAFIL red-clay filtration disc which is being in use in Orissa and few other states. It can be fitted with any household container for filtration of high turbid water very effectively. 99% of turbidity and 95% of bacteria can be removed during filtration. This has been tested during super cyclone period in Orissa which highly successful. We are planning to send 1000 sets of 30 litre capacity (60-70 LPD) complete filter fitted with food grade plastic containers to flood affected areas of Bihar within next 20 days.

Please refer to a leaflet of TERAFIL water filtration technology for your reference. To read brochure click: <http://www.solutionexchange-un.net.in/drm/cr/res01090822.pdf>. We require assistance for local transport and distribution of the filters in few affected areas of Bihar. UNCEF or any organisation can help us in this regards.

Rahul Pathak, CSR & Disaster Management Cell, Aquaplus Ltd., Pune

Referring to you mail we am glad to introduce ourselves as the manufacturers of Mobile Water Filtration System for DM. I am currently in Purnia, proceeding to Supaul for commissioning 3 Numbers of Water Filtration Systems for Art of Living & Oxfam. My working cell no is 9420482945.

Arunabha Majumder, Presidency College, Jadavpur University, Kolkata

The flood water can be treated by Coagulation, Flocculation, Sedimentation, Filtration and Disinfection.

It can be done in several ways:

- Treatment can be at household level, relief camp level or Community level.
- Alum or Poly Aluminum Chloride can be used as Coagulant. Higher dosage of alum or PAC is required to treat high turbid flood water.
 - Lime is to be added to keep pH between 7.0 and 8.0.
 - Bleaching powder or Sodium hypochlorite or Calcium hypochlorite is to be added for pre- Chlorination of water.
 - Above mentioned chemicals are to be added in flush mixing condition. Duration of flush mixing is 60 seconds. It is to be followed with slow mixing for 5/6 minutes.
 - Now the water is to be kept for at least 2hrs for settling.
 - The supernatant can be filtered by using sand-gravel filter or candle filter.
 - If filter is not available then folded cloth (few folds) may be used.
 - Post chlorination may be required to keep residual chlorine between 0.2 mg/l and 0.5 mg/ l.
 - At household level buckets (15 to 25litres) can be used. Candle filter or folded cloth filter is o.k.
 - At relief camps 80 litres or 100 litres plastic drum can be used. Sand- gravel filter can work better here. Burnt (clay +sand +husk) candle filters may be good to use.
 - Let us make pouch with chemicals (Alum + Lime + B.P.) aving written instruction of how to use it to purify flood water.
 - Sodis is very good after water treatment as mentioned above.
 - We have to remove colloidal and suspended solids including pathogenic organisms through water treatment.
 - West Bengal PHED has procured truck-mounted water treatment plant to treat flood water. Treated water is distributed in plastic pouch in flood affected areas.

Uday Bhawalkar, Bhawalkar Ecological Research Institute (BERI), Pune

Water pollutants that affect human life can be divided into:

- Inorganics such as nitrates, fluorides, sodium, chlorides, heavy metals, etc.
- Toxic organics such as pesticides
- Pathogens and pests that may breed in polluted water.

We studied water and wastewater (sewage, industrial discharges, etc.) over the past 36 years at Bhawalkar Ecological Research Institute (BERI), in Pune by taking 'collaboration from Nature'.

We found that the inorganic pollution is the root cause of all the pollution. This is precisely why Nature has provided us with a spare kidney. We all know that kidneys are there to remove inorganic pollution from our blood, through a membrane process. In fact, pathogens and pests breed only in water that has certain band of inorganic pollution.

Inorganic pollution reduces human creativity and increases drug addiction, violence and other negative aspects of human behaviour.

Many times, we fight with the signals of pollution (turbidity, pathogens and pests) because the root- cause is unknown or its remedy is not there.

Yes, turbidity also settles by itself once the inorganic pollution is taken care of, so do pathogens, pests and odour (another signal of pollution).

Sewage pollution is also controlled by inorganic pollution. We often 'treat' the sewage by removing the 'battery' that provides energy for the warning bell. Food organics are destroyed during the sewage treatment, only to 'shut up' the signals such as colour, odour, etc. But such energy-deficient 'treated sewage' is ideal food for malaria mosquitoes and pathogens. This is why chlorination of 'treated sewage' is strictly enforced.

This fact that 'energy-deficient inorganics-rich water is really harmful', can be understood by noting that cooling towers that mostly have no COD, breeds hazardous 'legionella or flesh-eating bacteria' and the aerosol from the ubiquitous cooling towers is a great hazard. So, is the aerosol from the conventional sewage treatment plants.

Having understood this, we should use plant roots; this is the sole mechanism to remove inorganics through their utilisation. This approach also avoids creation of another concentrated waste stream and generates resources (food, fuel, fibre, etc.) for man and his pets.

Use of plant roots for water (and wastewater) purification is also known as phytoremediation or root-zone technique. One can find thousands of pages of information through Google search on these terms.

To reduce the area of this eco-filter further and reduce the time of setting the eco-filter in action(at least 3-6 months), we have developed BIOSANITIZER ecochips that can start the water treatment within a minute, just by dropping the ecochips in polluted water(well, borewell, water tanks, ponds, lakes, also into flowing water streams and rivers.

100 mg of BIOSANITIZER ecochips (about 4 chips) carry out the water(or wastewater) treatment that can be carried out by 1 acre of eco-filter that may cost a lot to construct in urban area.

In villages, soil acts as an eco-filter and this is why we could use the treated groundwater as safe source of drinking water over a long period, till the advent of chemical fertilisers that reversed the role of soil, from cleaning filter to polluting dead medium.

BIOSANITIZER ecochips can be dropped in floodwater to clean the whole connected water body. After this is done, water will have self-settling ability and the supernatant clear water can be safely consumed. To help the human psychology, may be it can be filtered through cloth to remove some suspended particles. Or a sand filter can be assembled. After the BIOSANITIZER-treatment, the sand filter needs no cleaning and soon grows an ecological garden on it, making it an eco-filter, too.

Floodwater that is remediated with the BIOSANITIZER ecochips, shows resistance against scaling, corrosion, biofouling, algal growth and breeding of pathogens/pests. This makes flood-rehabilitation easier and the flooded soil can get a new life because of the BIOSANITIZER action.

The technology was well demonstrated twice in Mumbai floods, please see <http://www.wastetohealth.com/ecore restoration.html>.

How much quantity is needed for the Bihar flood? Smaller is the quantity, if application is closer to source of flood, in Nepal in this case.

An investment of 1 Rs or \$ gives benefits of 1,000 units just in a week's time. This is because pollution is converted into resources.

Eric Lemétais, L2i Consultants, France

Following your very interesting notes, we are French consultants working with the moringa tree, readily available in India and Bangladesh. With the moringa seeds, you can locally manufacture soaps bringing an excellent sustainable revenue for the people. With the moringa seeds, you can purify any dirty waters, removing 99% of the turbidity and 95% of the bacteria. Then, you can easily use three processes to get drinking water with Sodis, claypot (up to 2 microns) and sand filter.

We have used this clay pot filtration and moringa seeds in Kenya with incredible results. For more information email: eric.lehavre@wanadoo.fr

Krishan Khanna, iwatch (www.wakeupcall.org), Mumbai

Please contact De Nora India Ltd, Goa

They mfg water electrochlorinators which work on solar power and use ordinary salt as raw materials. About 4.5 kgs of salt for disinfecting one million litres of water for drinking purposes. Please also see www.titanor.com.

J. Prakash, Knowledgelinks, Ghaziabad

The information in the following links may be of some help www.epa.gov/OGWDW/faq/emerg.html, www.thefarm.org/charities/i4at/surv/bleach.htm

How ever using alum and chlorine for purifying large amount of water to be used as drinking water may be relevant in this case.

Krishnan S. Raghavan, Asian and Pacific Centre for Transfer of Technology (APCTT), New Delhi (response 2)

UN-APCTT has created a Disaster Management and Mitigation Technology Database in its key technology transfer portal, www.technology4sme.net. Following is a short list of few selected water purification technologies chosen from the APCTT's Disaster Management Database, which might be useful in the disaster management activities in Bihar.

Mobile Water Purification Unit for Safe Drinking water

The mobile disaster management unit (DMU) was developed by Ion Exchange India to meet the critical need for safe drinking water during disasters such as droughts, cyclones, floods and earthquake. During such times water supplies get contaminated with suspended solids, dirt, clay and pathogenic bacteria, spreading disease and epidemics. It can treat any kind and quality of surface or high salinity ground water to produce drinking water conforming to international standards; it can also treat chemically contaminated water. Moreover, treatment plants specifically for removal of iron, arsenic, nitrates or fluoride can be added on when required.

Zero-B Srijal Low-cost Disinfecting Unit

Zero-B Srijal Low cost disinfecting unit does not require piped water or electricity. Water passing through Srijal undergoes a two-stage purification process. First, a filter pad removes suspended dirt and mud, and then the water passes through a Zero-B resin chamber where harmful bacteria and viruses are eliminated.

Zero-B Suraksha

Zero-B Suraksha is an economical on-tap purifier based on the Zero-B resin technology. The unit is simple, convenient and does not require electricity.

Jalshudhi Disinfection Capsules

Jalshudhi Disinfection Capsules are low-cost, easy-to-use capsules that remove the soil sediments and bacteria

completely and provide a safe drinking water. Jalshudhi capsules not only effectively disinfect water but also purify muddy, turbid water. The capsules come in two capacities - Jalshudhi-01 can purify 1 litre of water and Jalshudhi-05 can purify 5 litres. The residual purifying effect lasts 48 hours.

For more information on the technologies mentioned above, please contact:

Ion Exchange (India) Ltd.,

Tiecicon House,

Dr. E. Moses Road, Mahalaxmi, Mumbai-400 011, India Tel: (91) 22 3989 0909

Fax: (91) 22 2493 8737

E-mail : hocro@ionexchange.co.in; ieil@ionexchange.co.in Web: www.ionindia.com

4. Membrane Filtration Based Water Purifiers

Polymer Division of National Chemical Laboratory, Pune, India has developed a water purifier that requires no electricity, which can be set up in 10 minutes in the remotest areas, and that filters out even viruses. The filter has immense potential in rural and disaster-prone areas. A unique aspect of the ultra filtration (UF) membrane is that not only does it clean the water of all suspended particulate matter and bacteria; it also gets rid of harmful viruses. The membrane technology, which was granted a US patent earlier this year, does not depend on electricity, unlike other water filters. It can be used in remote rural areas as well as disaster zones where safe drinking water is not easily accessible. The ultra filtration membrane is being marketed under the brand name 'Purioin'.

One version of the membrane, Purioin XL, that costs Rs 18,000, has been designed specifically for rural application. The membrane is fitted with a hand pump and can purify 150 -200 litres of water in an hour, without using electricity. This easy-to-deploy rural version of the filter weighs just 18 kg and can be fitted in 10 minutes using any available water source. Purioin is available in two other versions -- Purioin Plus, that costs INR 7,500 and filters one litre of water per minute, and Purioin Elite that can filter two litres of water per minute and costs INR 10,500.

For more information on the technology mentioned above, please contact

Subhash Devi Membrane Filters (India) Pvt. Ltd

A-3, Saket,

45/1, Next to Patwardhan Baug,

Karve Nagar, Pune 411 052, India

Tel: 020- 56241874 / 09822099528

E-mail: membranefilters@vsnl.net; subhash.devi@usa.net

Please feel free to contact me, for any further information and assistance.

N. M. Prusty, CARE, New Delhi

Many of the DM Community members will probably know of TERA FILTER developed by CSIR Lab at Bhubaneswar (scientist is Dr. S Khuntia, cell; 09437012679) which is an extremely cost effective, technologically superior and very much based on the principles of appropriate technology. More details can be obtained by contacting the concerned scientist directly or visiting their website.

Atal Behari Sharma, Camp: Khagaria, Bihar (response 2)

I will still insist that in large part of affected area deep sinking hand pumps are appropriate and technology is known to people it is easy for maintenance. So suggestions like water purifiers of Rs. 1,800 is good enough of one families what is need now is to provide water to thousands of people at campsites.

One can test the waters from these hand pumps whether it is safe to drink?

Prakash Kumar, Consultant for SEI-United Nations Children's Fund (UNICEF), New Delhi

To treat water post disaster, follow these steps suggested by American Red Cross:

Filter the water using a piece of cloth or coffee filter to remove solid particles.

- Bring it to a rolling boil for about one full minute.
- Let it cool at least 30 minutes. Water must be cool or the chlorine treatment described below will be useless.
- Add 16 drop of liquid chlorine bleach per gallon of water, or 8 drops per 2-liter bottle of water. Stir to mix. Sodium hypochlorite of the concentration of 5.25% to 6% should be the only active ingredient in the bleach. There should not be any added soap or fragrances. A major bleach manufacturer has also added Sodium Hydroxide as an active ingredient, which they state does not pose a health risk for water treatment.
- Let stand 30 minutes.
- If it smells of chlorine. You can use it. If it does not smell of chlorine, add 16 more drop of chlorine bleach per gallon of water (or 8 drops per 2-liter bottle of water), let stand 30 minutes, and smell it again. If it smells of chlorine, you can use it. If it does not smell of chlorine, discard it and find another source of water.

Taral Kumar, Akar Impex (P) Ltd., Noida

There are technologies to cater to every situation and need but there is plain apathy at the level of the government which wants to carry on the history of mismanagement for disaster relief. For flood situations, there is a water treatment plant consisting of filtration and disinfection that can simply take river water and convert it to drinking water while removing the silt and sand and disinfecting it for making it fit for human consumption.

You may contact Taral Kumar (Exec. Director) of Akar Impex at this email and akarimpex@hotmail.com or akarimpex@gmail.com for more information on the type of system that can be provided the system can be boat mounted to enable one boat to cater to an area and provide relief during flooding conditions; but it needs sincere effort from the concerned authorities to do it.

Pramel Gupta, Pragmatix Research and Advisory Services Pvt. Ltd, Bhopal

Solar water disinfection (sodis) is simple technique to, improves the microbiological quality of drinking water, using solar UV-A radiation and temperature to inactivate pathogens causing diarrhea.

This is very low cast technique for water purification; need only quality pearl pet bottles for each H/hs as per the daily drinking water requirement. For detail you can see the website <http://www.sodis.ch/>

Prakash Kumar, Consultant, SEI-United Nations Children's Fund (UNICEF), New Delhi B (response 3)

Link for fact sheet on flooding and communicable diseases-Risk assessment and preventive measures is <http://www.who.int/hac/techguidance/ems/flood cds/en/>

Mazhar A. Rashidi, Pratinidhi, Lucknow

We are having wonderful experience of working in Public Private partnership with Academy Of Educational Development (AED) in Urban Slum of Lucknow. The model is running very successfully and has tested a number of demonstration and operation research models. This has resulted in the development of scalable and sustainable strategies for increasing penetration of POU water purification devices amongst the poor in India and worldwide.

This approach has been acclaimed worldwide. In this regard we would like to have your support and cooperation for the future scaling up strategies. We are sharing with you the 2 PDF documents sent by Mr. Deepak Saxena, Country Director. We hope it is very useful to all of us, seeking your support and cooperation in the future endeavors. To view the documents please click

<http://www.solutionexchangeun.net.in/drm/cr/res010908024.pdf>; <http://www.solutionexchangeun.net.in/drm/cr/res010908025.pdf>

Sukanta Kumar Rath, Independent, Jagatsinghpur, Orissa

I would like to share the following regarding water purification technologies and their availability

- The reverse osmosis water purification technology is used for purifying water having less than 2000 Total Dissolved Solids (TDS) level in the water along with an ultra violet lamp which clears all bacteria. This system keeps the TDS level within 0 to 100 level which is prescribed by the WHO and ISI. This also purifies the

fluoride content of the water if any and other harmful contaminants.

- TATA Projects Limited has designed mobile water purification systems i.e. the reverse osmosis system is fitted in a vehicle which can provide water to the affected villagers on emergency. 10'x12'x10 space is required for mounting the R.O system for 1000/1500/2000 LPH (Litre per hour) capacity water purification plant. TATA projects have used such mobile water purifying vehicles during their relief operation at Nagapattinam in the aftermath of TSUNAMI to purify saline water. If you want the details of the company, cost etc. I shall provide. There are many other companies in India which supplies RO plants, but do not guarantee ISI standard water quality, they use some chemical for taste.

Rita Salva, Independent Consultant, Mumbai

I was working on DRM Project of UNDP as a project officer for Mumbai. Now I organize freelance school safety, community base DM Training programmes in Mumbai.

In ancient Jain Religious books it is written about purification of water which is now also practiced by Jain Community.

Equal part of Cow Dung and wood is burnt to ash, which generally comes after using it for cooking. Which is called "VANI". 100 gms of this ash can purify 20 liters of water.

Water is kept under sun for 45 minutes after mixing with ash and this water is filtered with plain cloth and it makes water as pure as zero bacteria.

Science behind this is ash of wood and cow dung act as a catalyst to kill bacteria. This method is scientifically proved.

Praveen Kumar Amar, Consultant on Disaster Management (Natural & Man Made), New Delhi (response 2)

I would like to present the standards that should be adopted by the states although still under evaluation and open for comments for distribution of water during emergencies and disaster situations.

Water Requirements Minimum Standards

Minimum standards of safe and wholesome water in relief for shelter, food, drinking, medical cover and sanitation to be provided to persons affected by disaster should be evolved after taking into account the threshold limits of:

- Topography, Habitat, Temperature, Humidity and Wind velocity
- Type of Shelter, Accessibility, Density in Lodging, if Mobile then Kind of Mobility
- Displaced Population
- Kind of Medical Facilities Available
- Demographics - Cultural Traditions, Ethics, Practices and Attire
- Food - People Cook and Eat
- People's Normal Habits of Personal and Domestic Hygiene
- Pattern of Sanitation Facilities Available
- First Responders Protected and Unprotected
- Search and Rescue Missions
- Maintenance of Essential Services and their Requirements
- Any other category of people or group of services, the survival of which is integral to providing relief or essential in being provided relief

Minimum drinking water requirement through ingestion for survival, excluding food & other intakes:

- Temperature 50°C 41.5°C 38.8°C 33.1°C 27.8°C 22.1°C and less
- Minimum Requirement of Drinking 2.92 ltrs 1.89 ltrs 1.56 ltrs 1.42 ltrs 1.32 ltrs 1.28 ltrs
- Water Per Day in Litres for Males {more than 10 Years} 100%
- Females {more than 10 years} 80 %
- Hermaphrodites 80%
- Child (5+ to 10 years) 50 %
- Child (3months to 5 years) 35 %

Add Extra Allowance:

- HIV/ AIDS Patients 50%
 - Terminally ill Patients 25%
 - Diabetic & Hypertensive 25%
 - Pregnant Women 12%
 - Menstruating Females 05%
 - Lactating Women 40%
 - Immuno-suppressed Patients 25%
 - Senior Citizens > 60 years 25%
 - Traumatized Physically 25%
 - Traumatized Mentally 50%
 - Orphans 25%
 - Widows 25%
- to be adjusted as per medical advice

Warning:

- Maximum hourly intake should not be more than 1.03 liters nor more than 11.35 liters per day
- One should not eat snow, as this will expend more energy melting it in the mouth and can be fatal. Seawater, even if diluted with fresh water and drunk in small quantities leads to death. Drinking Flooded and Marooned waters could be potential health hazard, many a times fatal.
- The requirement of water for the individuals varies from person to person. Under normal conditions, a person needs to drink 1.5 - 2.5 litres, or 8 glassfuls of water per day. For an inactive person in Antarctica, the minimum requirement is 2quarts i.e 1.90 litres - 2.0 litres

Relief is to be provided in Four Phases, namely:

Phase I	Immediate	upto 03 Days	For Survival
Phase II	Short Term	04 to14 days	For Physiological & Psychological Needs
Phase III	Medium Term	15 days to Two Months	For Maintaining
Phase IV	Long Term	beyond Two Months	As Lasting Solution

Abhishek Mendiratta, Consultant, New Delhi

Tracking the bacteriological contamination of drinking water sources in the villages/slums can be done using H2S vials. Bacteriological contamination can be identified by storing the water to be tested for 16 to 24 hrs in the H2S vial bottles and later observing the changes in the colour of water. Most of these kits can be used even by school children with proper training.

Yusuf Kabir, United Nations Children's Fund (UNICEF), Kolkata (response 1)

I think this is a very valid query raised by Mr. Padmanabhan at appropriate time.

For the last few days, I have following the responses, and it is really exciting for me to know about so many water treatment technologies available.

Household level water treatment technologies have become a very lucrative business proposition. Many agencies are in operation and it becomes often difficult to select the appropriate one.

I am sharing certain practical problems that emergency response agencies normally face in the field while application of this technologies.

When does POU does not work?

- Poor product
- Inappropriate product
- Unconvinced users
- Not cost effective

Therefore what we need?

HHWT is not about products and technologies but community mobilization, social marketing and behavior

change; it is therefore important to have a rigorous communication plan in place involving all partners and channels of communication

What are the essential requirements for HHWT facilities?

- Community acceptance/knowledge to perform operations and maintain process
- Vessels for collecting, treating and storing water
- Materials/chemicals to apply treatment process
- Means to re supply consumables (especially during floods)

Table 1: Scale of POU worldwide

Product	Countries	Estimated Users
SWS	26	20 million
Aquatabs	4	1.1 million
Ceramic	19	1.0 million
SODIS	20	2.2 million
PuR	7	0.06 million
BioSand	36	0.68 million
TOTAL		25.04 million

Table 2: Overview of cost

Water treatment Method	Cost/per/yr
Solar Disinfection	US\$0,63
Chlorination	US\$0.66
Ceramic Filters	US\$3.03
Combined flocculation/Disinfection	US\$4.95
Installing & Maintaining Wells, Communal Tap Stands in Africaborehole and	US\$1.88

H. S. Brahma, National Disaster Management Authority (NDMA), New Delhi

Thanks for the immediate response. However there would be requirement of long term Drinking water supply scheme in these flood affected districts. In fact most of these DW sources would be silted excepting the borewells. Hence the mobile Purification plants would be ideal for some time. You may suggest NGOs to organise the same for Demonstration / Pilot projects in the affected areas.

Sudesh Menon, WaterHealth India Pvt Ltd, Secunderabad

WaterHealth India is a company focussed on providing safe potable water in remote rural villages. We have installed more than 200 systems in villages of Andhra Pradesh and work with the community in an inclusive manner. The WaterHealth Centre is scalable and can provide water to communities with population varying from 2,500 to 10,000 people. The system is modular which enables rapid deployment.

WaterHealth has installed systems in Sri Lanka after the Tsunami and has experience working in difficult disaster/emergency situations.

We would be happy to provide solutions to the flood affected areas in Bihar.

For more information, please contact:

Sudesh Menon
 WaterHealth India Pvt Ltd
 No. 206, Ashoka MyHome Chambers
 1-8-301, S. P. Road, Secunderabad - 500 003, Andhra Pradesh, India
 +91 40 2789 0307/08/09 telephone
 +91 40 2789 0309 fax
 +91 (98) 66017450
www.waterhealth.com

Arshinder Kaur, Organic Farming Council of Punjab, Mohali

Kindly find a link to the SODIS Technology <http://www.sodis.ch/files/SODISManualenglish.pdf> as a secondment to one of the replies as a solution to this query.

B. K. Khanna, Consultant for National Disaster Management Authority (NDMA), New Delhi

I have been going out often for conducting mock exercises and drinking water has been perpetual problem area. Recently there is a pump like gadget which has come in the market. It is like a cycle pump, but shorter version, weighing less than 3 kgs. It has two pipes, one u put in the dirty water and the other in the empty bottle, or bucket, u pump from top like a cycle pump and drinking water comes in

to the bucket/bottle. The smaller version costs about 12000/- and 50,000 liters water can be pumped with one candle. Then u change the candle which comes for about Rs. 4,000/- and again can pump over 50,000 liters of water. They also have it in bigger version, which pumps one lakh liters of water. This i think is ideal for a flood like situation.

In case interested, please give me a tinkle at 9911297972, I will get the concerned dealer introduced. In case you want me to tell him where to approach, please give me the telephone number and I will direct the concerned dealer to directly deal with the person.

S. Khuntia, Institute of Minerals and Material Technology, Bhubaneswar (response 2)*

We are in process of distributing 1,000 sets of TERAFIL water filters among the victims of Bihar flood affected areas for supply of drinking water. These filters can provide at least 50,000 litres of clean drinking water every day, which can be operated without electricity by the victims easily, like any other candle filters. Each Terafil filter can supply drinking water to minimum 20 persons in a day.

We want to know the addresses of places for distribution of the filters directly to the victims in Bihar, which should be accessible by road and trouble free. Any body can inform the addresses.

Rudra Rath, Orissa State Disaster Management Authority, Cuttack

I have worked with UNDP Orissa since last two years as a project Officer for last two years. While preparing the CCP of the Bilipada a small village in the Banki Block we came across some of the indigenous methods used for purifying water. The scientific base of these techniques are yet to be proved, hence the scientists can work on the issue. However, for wide dissemination I would like to share few points with all of you.

The villagers collect the muddy water from the river if the flood water remains stagnated for 10 to 15 days in the village. They store it in the bronze and copper vessels.

Then they add some salt to the water. After few minutes the mud, colliods and particles are deposited on the bottom of the vessel. The upper crust of the water is collected care fully and then this is filtered through cotton clothes. This filtered water is then boiled to get the purified water. This technique may not be handy for a large community but it certainly can be a major breakthrough for providing water to a moderate sized family.

However, I am not sure above the scientific validation of the comments. But the elder villages say that this practice has been used by the older generation and were quite a useful one.

Yusuf Kabir, United Nations Children's Fund (UNICEF), Kolkata (response 2)

There is no doubt that SODIS is one of the most cost effective HHWT technologies, but, we need to further understand its appropriateness during flood or flood like situation.

SODIS technology does not work effectively in cloudy days and with raw water turbidity higher that 30 NTU. In monsoon days or flood situation it is very difficult to get a sunny day. In addition, high turbidity of flood water for application of SODIS is a challenge.

Therefore, for every technology, we have to understand its benefits, drawbacks and appropriateness.

Please see the following documents, which have information on different treatment technologies and their appropriateness in floods or flood like situation. To view the documents click:

[Http://www.solutionexchange-un.net.in/drm/cr/res01090826.pdf](http://www.solutionexchange-un.net.in/drm/cr/res01090826.pdf)
[Http://www.solutionexchange-un.net.in/drm/cr/res01090827.pdf](http://www.solutionexchange-un.net.in/drm/cr/res01090827.pdf)
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<http://www.solutionexchange-un.net.in/drm/cr/res01090829.pdf>

I hope you will find these useful.

Shalina Mehta, Punjab University, Chandigarh

I have followed with interest this query. I have from time to time printed some replies and put it on the notice board for the information of our students who spend quite sometime in the field. I am of the opinion that this vital information should be made available, of course after authentication by a team of scientists and be provided free of cost to various schools in remote rural and tribal villages, urban slums and all the NGOs working in such locations.

I would like to go a step further and insist that this be made an essential component of school text books and for all mandatory environment courses being taught in schools and colleges.

Please give due consideration to its operational feasibility.

Vinay Chopra, De Nora India Ltd., Kundaim, Goa

Electro chlorinator based on salt/water and electricity or based on solar energy where electricity is not available is one of the most preferred disinfection method used in India. It eliminates the logistics problems in regions particularly which are cut from the main streams in the event of flood etc., for sourcing other chlorination alternatives, for example, stable bleaching powder, gas chlorination toners, granules, chlorine tablets, commercial sodium hypochlorite, etc.

WHO Guidelines (www.who.int/water_sanitation_health/dwq/gdwq3/en/) listed electro chlorination as one of the processes of disinfection of drinking water. Refer to page 171 Chapter 8 of the World Health Organization, "Guidelines for drinking water quality" first addendum to third edition, 2006. It clearly states, "Chlorination can be achieved by using liquefied chlorine gas, sodium hypochlorite solution, calcium hypochlorite granules and on-site chlorine generators."

De Nora India (formerly Titanor Components, www.denoraindia.com) is the pioneer in the introducing Electro chlorinators in India and since 1996 has supplied about 700 units to various government or semi- governments organizations. Our product is registered with United Nations under Vendor ID No. 23338.

We can supply large quantities at short notice from our state of the art manufacturing facility at Goa.

Nimish Arora, Ion Exchange, Mumbai

We received your mail through Ms. Chandan Chawla, first of we would to express our thanks for giving us the opportunity during this national calamity to provide safe drinking water in Bihar.

We will be able to immediately support you on the following

- ZeroB Suraksha - it is tap attachment purifier, which purifies 7,500 of water on tap and can be packaged and re-distributed. We will be able to give you 500 pieces of same at Patna.
- Water vending machine - 150 litres per hour runs on electricity. It is a RO based purification system which has sediment filter cartridge, carbon cartridge, RO membrane, back up disinfectant cartridge and carbon cartridge. The storage capacity of this unit is 100 litres. Water can be stored in external container. You can take this unit from our Vashi office address after 4 days and contact details are: Nimish Arora, Ion House, Plot no-2, sector 18, Vashi, New Mumbai
- Disaster Management unit - we have supplied two disaster management unit to PHED West Bengal. Presently these units are based at Malda and Barasat in West Bengal. Your organization can get in touch with them and seek their help on the same.

We are extended our help in this hour of need for Bihar and for UNDP.

Many thanks to all who contributed to this query!

If you have further information to share on this topic, please send it to Solution Exchange for the Disaster Management Community in India [at se-drm@solutionexchange-un.net.in](mailto:se-drm@solutionexchange-un.net.in) with and/or Solution Exchange for the Water in India [at se-wes@solutionexchange-un.net.in](mailto:se-wes@solutionexchange-un.net.in) with the subject heading "Re: [se-drm] [sewatr] Query: Water Purification Technologies for Flood Affected Bihar - Experiences; Referrals. Additional Reply."

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