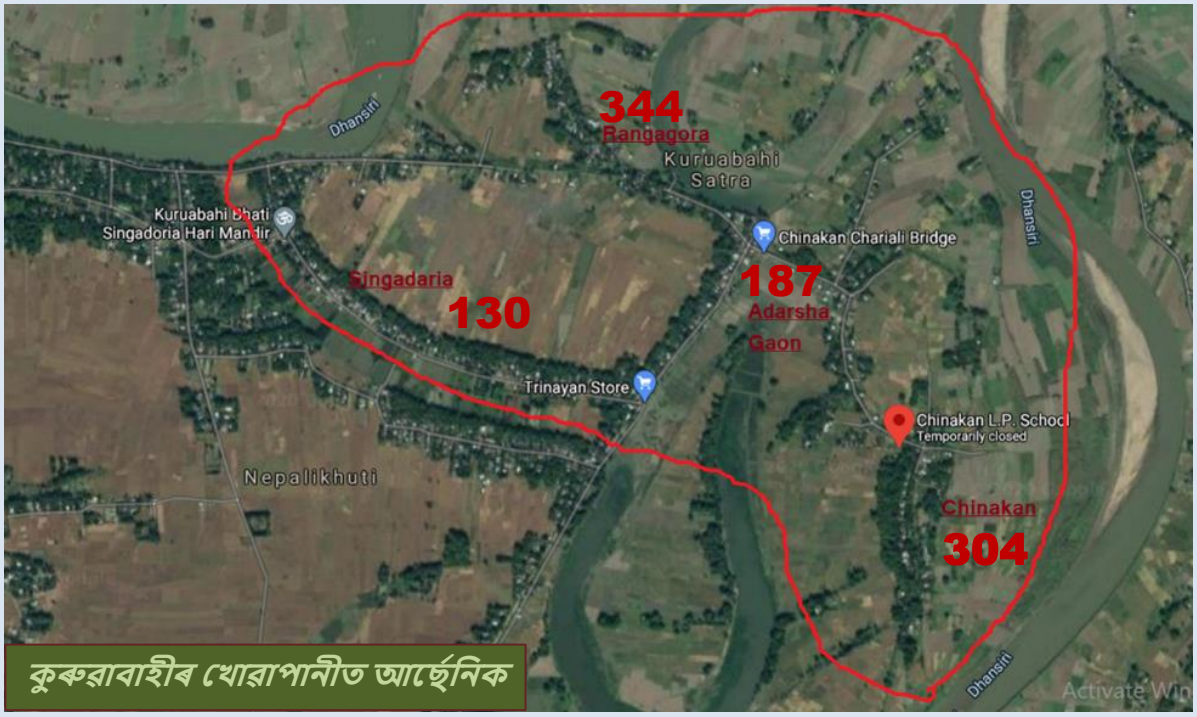
Project Completion Report

Sponsored by

Numaligarh Refinery Ltd.

Under CSR Activity

Title of Project: **Arsenic removal from drinking water using do-it-yourself Arsiron Nilogon Method**



Implementing Agency: **Department of Chemical Sciences**
Tezpur University

Project Coordinator: **Prof. Robin Kumar Dutta**

Duration of the Project: **1 year 16 days (16/12/2020 to 31/12/2021)**

Amount involved: **₹ 19,80,000.00**

4 March 2022

Completion Report

NRL-Sponsored Project (A piloting)

Under CSR Activity

Summary

Title of Project:	**Arsenic removal from drinking water using do-it-yourself Arsiron Nilogon Method**
Name of the Organization:	Tezpur University, Napaam, Tezpur
Implementing Department:	Department of Chemical Sciences, Tezpur University
Project Coordinator:	Dr. Robin Kumar Dutta, Professor, Department of Chemical Sciences, Tezpur University, Tezpur 784028, Assam
Date of Agreement between: NRL& Dept of Chem Scs,TU	09/11/2020 *(Agreement valid for 15 months, till 08 Feb 2022)*
Duration of the Project:	1 year 16 days *(16 days extended due to COVID-19)*
Date of start of the Project:	16/12/2020
Date of start of the Project:	31/12/2021
Amount sanctioned:	₹ 19,80,000.00
Total amount received:	₹ 18,81,000.00 (*Remaining Instalments ₹ 99,000.00, 5% of the total sanctioned amount)*
Expenditure incurred:	₹ 19,80,000.00
Excess expenditure:	₹ 99,000.00
Amount to be released by NRL:	₹ 99,000.00 *(As the third instalment)*

Aim & Objectives of the project

Introduction:

Arsiron Nilogon is a do-it-yourself rural technology for removal of arsenic and other heavy metals from contaminated drinking water. Common people can make Arsiron Nilogon filter at home by themselves using easily available materials with a very low cost. The method involves treatment of the water with three very common chemicals in specified quantities and order, followed by sand-filtration. The common chemicals are cooking soda, potassium permanganate and ferric chloride. The chamicals are safe and used worldwide for water purification. They are available in village shops or online retailers and now also in convenient form from a supplier.

Our motto is the proverb:
Give a fish to a man, he will eat for the day;
Teach him how to catch fish, he will eat for his life.

The implementing agency of the project, the Department of Chemical Sciences, Tezpur University, through the inventor's research group, has been implementing and providing technical support in arsenic and also fluoride removal works in entire Brahmaputra Valley and also reaching out to several other states of India like Bihar, WB, etc., in association with various organizations. It was thought to be very helpful for the people of the neighborhood of NRL and the people of Golaghat district at large to give a thrust on the work there with financial support of the NRL. There is no possibility of duplication of arsenic removal works, in the area, done by us with that of other agencies. This is because, other agencies usually provide Community water supply systems, whereas, we only empower the people to do it by themselves.

This pilot project entitled, "Arsenic removal from drinking water using do-it-yourself Arsiron Nilogon Method", funded by Numaligarh Refineriy Limited, has been implemented by the Department of Chemical Sciences, Tezpur University with Prof. Robin Kumar Dutta, the principal inventor of the Arsiron Nilogon technology, as the coordinater during 1 Dec 2021 to 31 Dec 2022.

Aim:

This pilot project aimed to solve drinking water arsenic problem at four habitations, namely, Singadoria, Chinakan, Adarsha Gaon and Rongagora of Kuruabahi village in Golaghat district through creation of awareness about arsenic contamination of drinking water, ill effects of drinking arsenic-contaminated water and the importance of removing it from drinking water, and helping them in acquiring arsenic-free water using household Arsiron Nilogon filters and kits.

The piloting was planned to be completed within a year from the start of the project. It was planned to cover a total of 300 families from Kuruabahi village.

Objectives:

The following objectives were set to accomplish the aim in the proposed pilot project:

a) Creation of awareness among the people of the chosen habitations about arsenic contamination of drinking water, its adverse health effects and the importance of removal of arsenic from drinking water.

b) Capacity building to be done to prepare a group of volunteers from each of the four habitations to support the work.

c) Testing of arsenic in groundwater sources of all groundwater sources of the chosen habitations, which are used for drinking purpose. Presence of iron, manganese, heavy metals and other related water contaminants also will be tested. It is assessed that the entire population in these habitations are at the risk of arsenic contamination.

d) The arsenic-affected people to be trained about how they can install a low-cost Arsiron Nilogon filter at home by themselves and how to use that for getting arsenic-free water.

e) Kits of Arsiron Nilogon to be produced to cater for the user for the entire year.

f) All 300 families from these four habitations to be provided Arsiron Nilogon Filters.

g) The performance of the household filters to be monitored for one year through periodic visits and testing of the treated water.

Work Done

(In one year and fifteen extended days)

The implementing agency, the Department of Chemical Sciences, Tezpur University, have met all objectives, in fact more, within the planned period of one year and extended fifteen days. The extension was necessitated by some difficulties including travel restriction and, total and partial closure of the university offices, laboratories and hostels for a long time.

The objective-wise accomplishment of the work during the project period have been summarized below:

Objective-wise accomplishment of proposed works:

Table 1: Objective-wise accomplishment of the project:

Sl No	Objective	Accomplishment
I	Creation of awareness among the people of the chosen habitations about arsenic contamination of drinking water, its adverse health	Accomplished through a) Two Major Workshop & Awareness program, one each at TU, and Kuruabahi

	effects and the importance of removal of arsenic from drinking water.	b) An initial Awareness program at Chinakan Chariali c) Two Workshop cum Training at Chinakan Chariali d) A final major Awareness and Training program at Kuruabahi and e) Educating the villagers through door to door visits.
II	Capacity building will be done to prepare a group of volunteers from each of the four habitations to support the work.	Accomplished through the above-mentioned workshops and hands on training to a group of 6 volunteers.
III	Testing of arsenic in groundwater sources of all groundwater sources of the chosen habitations, which are used for drinking purpose. Presence of iron, manganese, heavy metals and other related water contaminants also will be tested.	a) Testing of arsenic and other metals has been done in water samples from all groundwater sources of the villages. b) The filter is removing both iron also with arsenic very well. c) No other heavy metal was detected. d) (*Detail in Annexure A*)
IV	The arsenic-affected people will be trained about how they can install a low-cost Arsiron Nilogon filter at home by themselves and how to use that for getting arsenic-free water.	Completed as described in the accomplishment for objective I. (*Detail in Annexure A*)
V	Kits of Arsiron Nilogon will be produced to cater for the user for the entire year.	Completed. The Kits of Arsiron Nilogon have been prepared and provided to all **320 user families**.
VI	**All 300 families** from these four habitations will be provided Arsiron Nilogon Filters.	Completed. **320 families** have been provided Arsiron Nilogon filters Because we found 20 more families in the villages during our door-to-door survey.
VII	The performance of the household filters will be monitored for one year through periodic visits and testing of the treated water.	The monitoring has been done till the end of the project through 2 online meetings on Zoom platform and then by visiting each and every user household for collection of treated water sample, for interaction and feedback. (*Detail in Annexure A*)

Signature:

	(Robin Kumar Dutta)	(Ruli Borah)
Date: 28 Feb 2022	Principal Investigator & Professor	Head
Place: Tezpur	Dept. of Chemical Sciences	Dept. of Chem. Scs.
	Tezpur University	Tezpur University

Detail Report of Activities

A: Preparatory Works
Awareness, Survey and Panning

The project was started on 16 Dec 2020. A project team consisting of the Coordinator and three research scholars, namely, Mr. Shamiran Baroi, Mr. Saranga Baishya and Ms. Tushmita Das, was constituted for carrying out the project work as per the University procedure. The work was started acting quickly with an awareness program cum planning meeting on 22 Dec 2020 with select local people at a community hall at Chinakan Chariali, Kuriabahi.

A.1: First awareness program and planning meeting at Kuruabahi

On 22 of December 2020, we visited the Kuruabahi area where the project was to be implemented (**Figure 1**). We had an interaction with the members and the villagers present there where we informed the villagers in detail about the hazardous nature of Arsenic present as a contaminant in the groundwater there and its serious impact on health due to using it as drinking water for long. We also discussed in detail regarding the NRL-sponsored project and its implementation. There were some querries from the villagers, which were thoroughly explained. Mr Shriram Das, local ZPC member, Ms Rupa Bora, the President of Kuruabahi Gaon Panchyat and some local people from Chinakan, Adarsha Gaon, Rongagora and Singadariya habitations of Kuruabahi village were present in the meeting. The project team along with some of the villagers, including the ZPC member, visited the houses of some of the villagers to examine the existing situation. The villagers offerd to extend full support to the project team for implementing the project.

Figure 1: Left - The first awareness cum planning meeting of the project team with some leading people of the four selected habitations of Kuruabahi at Chinakan Chariali on 22 December 2020. Right - The project team visiting some families to examine the existing condition of drinking water.

A.2: Door to door awareness campaign, survey and collection of water sample

The project team visited each and every households that were to be covered under this project personally and all relevant information was collected. In our survey, we have found 320 households in the four habitations instead of 300 as known earlier. We received very good cooperation from the local peoples there during our visits. We had also personally interacted with all the family members and collected information about their existing sources of drinking water and the difficulties they were facing with drinking water. Record were made about each family including if they had previously suffered from any Arsenic related health problems. All the villagers are using personal tube wells and so water samples from each tube well were collected for testing. Two snapshots of door to door visit for interaction and sample collection are shown in **Figure 2**.

Figure 2: Left – Visit by the team members to a family for awareness creation and data collection and Right – Water sample collection by a team member from a private tubewell.

A.3: Testing of drinking water source samples from the villages:

Water samples from all source tubewells from these four villages in the month of Dec-Feb. and were tested at Tezpur University laboratory for their Arsenic concentrations and other possible contaminants. Arsenic and other metal ions were tested using a ThermoFisher Atomic Adsorption Spectroscopy (AAS) with Hydride Vapour Generation (HVG) and Graphite Furnace (GF) facilities available at the laboratory of Prof. Robin Kumar Dutta at the Department of Chemical Sciences, Tezpur University.

Testing of initial arsenic contamination in drinking water samples:

The samples were collected in 100 ml Tarson plastic bottles. They were acidified to pH 0.015 or less using concentrated HCL and kept at least overnight. The samples were than prereduced with ascorbic acid so that arsenic in arsenate form does not escape detection. Most of the samples the concentration of Arsenic were found to be contaminated with arsenic more than the permissible limit of BIS and WHO. The results are shown in part in **Table 2** and in detail in **Annexure A.**

Table 2: Details of beneficiaries, arsenic test results of their drinking water before and after treatment, status, summary feedback and photographs of the household Arsiron Nilogon filters at a few of the 320 households of four habitations of Kuruabahi village.

Habitation	Sl. No.	Head of Family	No. of family members	Contact No.	Arsenic in ppb#		Status	User feedback	Photograph of the filter with a beneficiary
					Before filtration	After filtration			
Chinakan No. 1	1	Dadul Das	3	6000917389	332	Not Detectable* (<1ppb)	Working well. Used once daily.	Satisfied	
	2	Bintu Das	4	Not Available	304	Not Detectable	Working well. Used once daily.	Satisfied	
	3	Raju Das	4	6003086467	194	Not Detectable	Working well. Used once daily.	Satisfied	
	4	Putu Das	4	6003086467	183	Not Detectable	Working well. Used once daily.	Satisfied	
	5	Puleen Bora	4	9101489442	169	Not Detectable	Working well. Used twice daily.	Satisfied. Taste of water found better.	

#**ppb** means **parts per billion** of **microgram per litre** (**µg/L**).

*Note detectable means less than 1 ppb. Complete list can be seen in **Annexure A**.

The highest arsenic concentrations were found as 344ppb (parts per billion) and 332ppm at tube wells of Shri Nripen Das of Rongagora and Shri Dadul Das of Chinakan 1, respectively. The number of households with arsenic concentrations in the drinking water in different ranges were as shown in **Table 3.** Among 320 households, 47 households were found to be consuming water contaminated with more than 100ppb arsenic, 88 households were found to be in the range of 50-90 ppb arsenic, 77 households were found to be in the range of 10-49 ppb arsenic, 26 households were found to be in the range of 1-9 ppb arsenic and 82 households were with arsenic below 1 ppb or undetectable. WHO as well as BIS have recommended a limit for arsenic in drinking water in 10ppb but WHO also says at the same time that drinking water arsenic can cause cancer even at 0.17 ppb. Due to this fact and a suggestion from the villagers, we decided to provide the proposed Arsiron Nilogon filters to all 320 families of the four villages.

Table 3: Number of households with arsenic in the drinking water in different concentration ranges

Range in ppb	**Village-wise distribution of household in ppb**				**Total**
	Chinakan	Adarsha Gaon	Singadariya	Rongagora	
above 100	**19**	**3**	**3**	**22**	**47**
50-99	**38**	**15**	**22**	**13**	**88**
10-49	**40**	**1**	**10**	**26**	**77**
1-9	**19**	**3**	**2**	**2**	**26**
Undetectable	42	0	4	36	82
Total	158	22	41	99	320

It may be noted here that we have found high arsenic contamination in drinking water of some schools and Namghars in the village as shown in **Table 4**. However, we could not install any small community Arsiron Nilogon filters in these schools and community places as there was no provision for that in this present pilot project.

Table 4: Arsenic contamination in some schools and Namghars at Kuruabahi village

Sl. No.	Habitation	School/Namghar	Arsenic (ppb) in tubewell water	Remarks
1	Singadariya	Pub Kuruabahi High School	**266**	**Alarmingly high**
2	Chinakan	Chinakan LP School	**78**	**Alarmingly high**
3		Namghar, Chinakan 1	ND	
4		Namghar, Chinakan No. 2	**80**	**Alarmingly high**
5	Rangagora	Pub Kuruabahi M.E. School	**16**	**Alarmingly high**
6		Kuruabahi Rongagora LP School	**29**	**Alarmingly high**
7		Pujari Namghar	**24**	**Alarmingly high**

B: Awareness, Capacity Building and Distribution of Arsiron Nilogon filters

Awareness of the villagers on arsenic contamination of drinking water, its health effects and its easy solution through Arsiron Nilogon filters along with distribution of the filters were done at the villages through a series of Workshops.

B.1: Workshop No. 1 (Major Workshop) on Awareness and Training on Arsiron Nilogon at Tezpur University

Venue: Council Hall, Tezpur University, Date: 2 March 2021

An Awareness and Training program on Arsiron Nilogon was organized on 2nd of March, 2021 at Council Hall of Tezpur University Campus where two hundred people from the villages including students of class 9 to 12 and some teachers participated. The meeting was held at Tezpur University to ensure full attention of the villagers.

Mr. Tirtha Pratim Hazarika from NRL also joined the meeting and addressed the villagers.

The project team presented a detail description of the Arsenic contamination of drinking water of the area, its ill effects on health and how to remove arsenic from drinking water using the simple method of Arsiron Nilogon. They stressed on how drinking of water, contaminated with Arsenic, can lead to deadly disease like cancer. The reports of the source tubewell waters collected from the households were shared in the meeting. Detail about the project being implemented for arsenic mitigation in the villages was discussed. The method of Arsiron Nilogon was thoroughly described and its use was practically demonstrated. Three snapshots from the workshop are shown in **Figure 3**.

It is noteworthy that one participant from Chinakan Chariali of Kuruabahi whose hamily is one of the four families who had been already using household Arsiron Nilogon filters for over 1 year informed with a lot of thankfulness that he and his wife have not experienced any acidity problem since they started using the filter, who otherwise were frequently facing the problem earlier. This is reasonable as the treated water frm Arsiron Nilogon use to have pH 7.3, slightly in the alkaline side, of course still in the middle of the acceptable range of pH for drinking water as per Bureau of Indian Staandards (BIS). Actually, all groundwater with dissolved iron use to have low pH, lower than pH7 because dissolved iron is a Lewis acid which make the water very slightly acidic. A long term use of such very slightly acidic water may also lead to acidity problem. But, the acidity problem decreases when the drinking water is treated by Arsiron Nilogon since the treated water of Arsiron Nilogon has a very slightly alkaline pH of 7.3. The final pH after Arsiron Nilogon treatment settles at 7.3 because of use of cooking soda, which is neutralized partially or almost completely by the iron solution (ferric chloride) added as coagulant.

Figure 3: Snapshots from the Awareness and Training on Arsiron Nilogon at the Council Hall, Tezpur University. Prof. Robin K. Dutta (top) from TU and Mr Tirtha Pratim Hazarika (middle) from NRL speaking at the workshop and two of the project team members demonstrating Arsiron Nilogon.

B.2: Workshop No. 2
Awareness and Training on Arsiron Nilogon and distribution of Arsiron Nilogon filters at Kuruabahi

Venue: Chinakan Chariali, Date: 5, 8 & 9 April 2021

It was decided to install Arsiron Niligon filter in arsenic detected sources phased manner. On 05-04-21, we organized a workshop come awareness program at a community centre at Chinakan Chariali and also distributed 50 Arsiron Nilogon filters to highly arsenic affected families. In this program along with villagers including the 50 beneficiaries, a local support group including the local ZPC member and three officials from NRL, including Mr. Rajkamal Saikia, were present. A snapshot from the workshop can be seen in **Figure 4**.

Figure 4: A still from the awareness and training program before distribution on 5 April 2021 at Chinakan Chariali community centre.

Distribution of firest 200 filters:

We distributted household Arsiron Nilogon filters of 40 litre capacity each with accessories, chemical kits and a mini poster on the Arsiron Nilogon method to those 50 selected families on that day. We got a very supportive and positive response from their villagers. 150 more filters were distributed in just two days in the same way with awareness and training programs. We distributed 75 filters each on 8 April 2021 and 9 April 2021. A total of 200 household Arsiron Nilogon filters were distributted in first phase. Some of the installed filters, the accessories can be seen in **Figures 5-7**.

The filter and accessories included:

(i) A 40 liter plastic drum for sedimentation of arsenic, fitted with a plastic tap and a sticker displaying the CSR sponsorship of NRL
(ii) A 16 liter plastic bucket fitted with a plastic tap, about 20 kg sand, some gravel for making a sand-gravel filter
(iii) An iron stand* for placing the filter
(iv) A miniposter briefing the Arsiron Nilogon method with acknowledgement to NRL

Figure 5: Three of the Arsiron Nilogon filters in use in the villages with beneficiaries

Figure 6: A Chemical Kit (left) and the sticker on the filter (right).

Figure 7: The mini poster with a brief of Arsiron Nilogon acknowledgement to NRL

(v) An additional 40 liter plastic drum was given to some families who did not have any arrangement for iron removal previously of their own.**

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*The iron stand was not included with the filter in the proposal. The beneficiaries were expected to make a bamboo or wooden stand on their own as an user participation. However, we realized later that it would be better to provide an iron stand also with the filters for their convenience as well as for the filter to look a little more impressive. The expenditures for the iron stand, which was about ₹ 1100.00, was managed with the already approved project fund with some internaladjustments.

**We asked the villagers to remove excess iron from the water by simple sand filtration prior to treatment by Arsiron Nilogon filter so that the procedure (recipe) becomes simple and the efficiency of arsenic removal is better. Many of the families already had their own set up of a sand filter for iron removal. If any iron remains after initial sand filtration, that is of course removed completely in Arsiron Nilogon. However, we had to give the additional drum to 60 families all together.

The Kit included:

(i) A bottle of 500g cooking soda (খোৱা চ'ডা, sodium bi-carbonate) with a small measuring bottle marked for 4g for dispensing
(ii) A 100ml bottle of 5% potassium permanganate (জাৰক দ্ৰৱ, oxidant solution) with another 30 ml in a dropping bottle for dispensing in drops and
(iii) A 500ml 25% ferric chloride (আইৰনৰ দ্ৰৱ, iron solution) with a 5ml syringe fitted with a silicon tubing for dispensing.

B.3: Workshop No 3
Awareness and Training on Arsiron Nilogon and distribution of Arsiron Nilogon filters at Kuruabahi
Venue: Chinakan Chariali, Date 17 Aug 2021

The distribution of the remaining filters were interrupted by COVID-19 and the travel restrictions due to COVID-19. We however continued the preparatory works for distribution of the remaining 120 filters.

B.3.1: Installation of the second lot of filters:
Installation of 320 in the place of 300 filters.

Actually, only 100 more filters were reqired to be installed to complete 300 filters as per the project proposal. But a total of 320 households were found during our visit to the houses of the villages for survey and source water sample collection in the beginning of the project instead of 300 reported earlier. We decided to install 120 filters instead of 100 more with the same sanctioned budget.

The remaining 120 units of Arsiron Nilogon filters were distributed on the 17 August 2021 along with awareness creation and training on Arsiron Nilogon. All covid related protocols were strictly followed in the program. Two snapshots of the function can be seen in **Figure 8** below. Mr. Prasanna Bhuyan, a retired science teacher of Kakodonga H.S. School who has long been associated with installation and promotion of Arsiron Nilogon was also present who give away some of the filters to the beneficiaries. Mr. Bhuyan was invited to add some more seriousness to the function.

Figure 8: Stills from program on 17 Aug 2021. The 2nd lot of Arsiron Nilogon filters ready for distribution (top) and a filter being offered to a beneficiary by Mr. Prasanna Bhuyan (bottom).

C. Installation, User-training and Monitoring of the Filters

C.1: Installation of the Filters:

Most of the filters were installed by the users themselves as they were trained repeatedly. The installed filters and their use were checked by the volunteers. Some of the users were helped in installation by a group of six local volunteer. Each and every household and filter were visited by the project group later again for checking the functioning of the filters, taking feedback and collecting treated water samples.

In the whole project work, Mr. Sriram Das, the local Councilor of Zila Parishad (ZPC), helped the project team in all respects like a local leader. He helped us in organizing meetings, creating awareness, and storing and distribution of filter materials. The volunteers were rigorously trained at Tezpur University in a workshop about 2 years before the start of the project. Some of them had been using the filters for 1-2 years installed by themselves. They were again trained at Tezpur University and the awareness and training programs at Kuruabahi. The volunteers helped us in storing and distribution of filter materials and installation of filters. Mr. Narayan Das and Mr. Papumoni Hazarika helped us in uninterrupted supply of the chemicals even during travel restrictions in between due to COVID-19. The names and contact details of the people including the volunteers from the villages who supported our work are given in **Table 4** along with contact information:

Table 4: The names of the people from the villages who volunteered and extended a helping hand to the project team along with contact information

Sl. No.	Name	Designation	Role	Village	Contact Number
1	Mr. Sriram Das	Local ZP Councilor	Main help in entire management	Singadariya	6001748911
2	Mr. Narayan Das	Farmer	Helps in distribution & installation of filters and supply of chemicals	Chinakan 1	6003622667
3	Mr. Papumoni Hazarika	Farmer & Bee-keeper	Helps in distribution & installation of filters and supply of chemicals	Chinakan 1	6001493153
4	Mr. Suren Das	Farmer & Contractor	Helps in distribution & installation of filters	Chinakan 2	9101410997
5	Mr. Akhil Saikia	Farmer	Helps in distribution & installation of filters	Chinakan 1	9395041865
6	Mr. Babul Das	Farmer	Helps in distribution & installation of filters	Singadariya	He does not have phone
7	Mr. Biswajit Das	Farmer	Helps in distribution & installation of filters	Rongagora	6003294482

C.2: Monitoring of Use and Performance of the Filters
Through dual offline-online modes

It was planned to monitor the use and performances of the filters through visits of the project team to individual houses to:

a) See the filters and the check the chemical kits
b) Interact with with the users to know whether they are following proper procedures or not and to know about their satisfaction
c) Collect treated water samples for testing at Tezpur University.

The collected water samples were to be tested at Tezpur University for checking the performance of the filters.

C.2.1: Set back due to COVID-19 in checking installation and performance of filters and alternative arrangement in distant modes

Travel restrictions due to the second wave of COVID-19 pendemic started soon after distribution of 200 household Arsiron Nilogon filters to 200 families in the four habitations during 5, 8 and 9 April 2021. These filters were installed by the villagers with the help of the local volunteers and used by the villagers for getting arsenic-free drinking water. However, the project team could not travel from Tezpur to Kuruabahi to visit the villages for about three months. Therefore, we had to look for some alternative stop-gap arrangements.

Telephonic Monitoring during COVID-19 restrictions:

The project team made telephoe calls to the families whose telephone numbers could be accessed. We have been constantly in touch with the beneficiaries over phone for following up the status, any difficulty faced by the and their feedback. We enquired about the status of the filters and the kits, repeated the procedure of use of the filter and the precautions to be taken and if any difficulty was faced by them. Apart from a few very minor issues, all the filters were reported to be working satisfactorily. The villagers expressed their happiness over phone.

Online Monitoring during COVID-19 restrictions:

Two online meetings on Zoom platform were held on the 2nd June and 24th July, 2021 for online monitoring of the performance of the 200 Arsiron Nilogon filters installed at Kuruabahi as we were not able to visit and personally meet the users due to COVID-19 restrictions. About 15 beneficieries and volunteers joined the meetings along with the ZPC member Sriram Das. The project coordinator, Prof. Dutta, hosted the meetings where he discussed and reviewed the ongoing implementation of Arsiron Nilogon filters with the beneficiaries. Apart from that few related queries were also resolved. All participants from the villagers expressed their satisfaction in the meetings except one lady in the first meeting. She complained that there was a lot of sediments found in the treated/filtered water. However, after detailed enquiry, during the meeting itself, it came to light that the sediment formation was shown by RO filter vendors by electrolysis using iron electrode to sell their product. The lady understood her mistake and finally the issue was resolved with full satisfaction of all the participating villagers.

C.2.2: Door to door visit for collection treated water sample, monitoring and user feedback

A door to door visit has been made soon after the travel restrictions were lifted to each household for the collection of treated water samples for testing of Arsenic and other heavy metals, collection of feedback from the beneficiaries and explaining/clearing of any doubts regarding the Arsiron Nilogon method. We have completed visits to all 320 households. The feedback was collected only in verbal manner due to inability of a large number of the villagers to give written feedback and also to avoid confusion and mistrust of the villagers about our intension. A detailed list of all 320 beneficiery households including the arsenic test results of water before and after treatment and summary feedback and photographs of the Arsiron Nilogon filters can be seen in **Annexure A**. The satisfaction of the users is evident from the expressions of the users in the photographs.

C.2.3: Testing of water samples before and after treatment and results

Testing of Arsenic in all 320 water samples collected from all 320 household Arsiron Nilogon filters after treatment have been done using a ThermoFisher Atomic Absorption Spectrophotometer fitted wirh a Hydride Vapor Generator (AAS-HVG) available in the laboratory of the project coordinator in the Department of Chemical Sciences. The results are included in **Table 3 & 4** (presented above) and **Annexure A**. It is interesting to note that **the arsenic concenntrations in all 320 water samples treated by the household Arsiron Nilogon filters have been found to be undetectable or below 1 ppb without any exception**. The maximum permissible arsenic concentration in drinking water as prescribed by the Bureau of Indian Standard (BIS) and the World Health Organization (WHO) is 10 ppb (parts per billion or μg/L). **Thus, the Arsiron Nilogon filters, sponsored by the NRL at the four habitations of Kuruabahi village, are efficiently removing arsenic from drinking water of all the households.**

The pH in all samples were found to be 7.3(±0.2), which is in the middle of the acceptable pH range of 6.5-8.5 for drinking water as prescribed by the BIS. Groundwater with dissolved iron usually have low pH, lower than pH7 because of dissolved iron. Iron ions are Lewis acids which make the water very slightly acidic. A long term use of such very slightly acidic water may lead to acidity problem. The acidity problem decreases when the drinking water is treated by Arsiron Nilogon bacause the final pH of 7.3 of treated water of Arsiron Nilogon. The final pH after Arsiron Nilogon treatment settles at 7.3 because of use of cooking soda, which is neutralized partially or almost completely by ferric chloride solution added as a coagulant.

A few random treated samples, one each from each of the four habitations, were tested for some other relevant water quality parameters, *viz*., Fe, Mn, Ni, Co, Cr and Al whose results are presented in **Table 5**. Among the other heavy metals, only Fe was found to be present in the range of 1.69 ppm to 5.54 ppm in the water before treatment. Mn, Ni, Co, Cr and Al were below the detection limits and also below the BIS specifications. The water samples collected from the same households after treatment of the water from the same respective sources

were found to be free from Fe. All these samples showed Fe below detection limit of 0.01ppm which is below the BIS permissible limit of 0.3 ppm.

Table 5: Detail analysis of arsenic and other metal ions in four select water samples, one from each habitation, of Kuruabahi village before and after filtration

Names and Addresses	Codes	[As] ppb	[Fe] ppm	[Mn] ppm	[Ni] ppm	[Co] ppm	[Cr] ppm	[Al] ppm	[F] ppm	TDS ppm
Mamoni Das, Chinakan	Before	98	5.14	ND	ND	ND	ND	ND	0.14	*
	After	ND	ND	ND	ND	ND	ND	ND	0.14	169
Bimal Das, Adarsha Gaon	Before	53	1.69	ND	ND	ND	ND	ND	0.10	*
	After	ND	ND	ND	ND	ND	ND	ND	0.10	265
Jiten Das, Singadoria	Before	82	2.25	ND	ND	ND	ND	ND	0.19	*
	After	ND	ND	ND	ND	ND	ND	ND	0.19	266
Uttam Das, Rongagora	Before	172	5.54	ND	ND	ND	ND	ND	0.22	*
	After	ND	ND	ND	ND	ND	ND	ND	0.22	149
BIS specifications	Permissible	**10**	**0.3**	**0.1**	**0.02**	**NS**	**0.05**	**0.03**	**1.0**	**500**
	Acceptable	**50**	**0.3**	**0.3**	**0.02**	**NS**	**0.05**	**0.2**	**1.5**	**2000**
Remarks		Safe after filtration	Safe after filtration	Safe	Safe	Safe	Safe	Safe	Safe	Safe

ND, not detectable means less than 1 ppb for As and less than 0.01ppm for Fe.
*TDS was not measured before treatment as dissolved iron, which greatly increases the TDS, was present in the water. The TDS before treatment in presence of iron is misleading.

As expected, the fluoride concentrations in the water before treatment were very low. In fact the water is deficient in fluoride. Such fluoride deficiency in the water is likely to cause tooth carriage (cavity). Use fluoride-containing toothpaste, which the villagers already have been doing, is a remedy for the fluoride deficiency. Arsiron Nilogon does not affect the fluoride concentration of water and as expected the fluoride concentrations after treatment by Arsiron Nilogon were found to be exactly same as before treatment. The TDS of the water samples, after treatment, were all well below the acceptable value of 500ppm.

It was also interesting to note that some of the villagers have said the treated water to have a better taste than before. This is because of slight increase in benign carbonate ion in the water due to addition of cooking soda, sodium bicarbonate, to regulate the pH for facilitating arsenic removal.

Thus, the measurement of arsenic concentrations and other relevant water quality parameters in the treated water samples showed the water as suitable for drinking.

D. Arrangement for Sustainability and Closure of Project

As the project was approaching completion, we wanted to organize a meeting in the form of a final workshop cum training for as a last opportunity to interact with the users and sorting out any difficulty that could arise in use of the filters. We also wanted to inform the users about what to do for continuous availability of the chemicals in the meeting and apprize about the program to some leading people of other Gaon Panchayats and some school teachers.

D.1. Workshop No 4

Concluding Workshop on implementation of Arsiron Nilogon at Kuruabahi

Venue: Gaon Panchayat, Kuruabahi, Date: 20 November 2021

A day-long concluding workshop on implementation of the piloting of Arsiron Nilogon at four habitations of Kuruabahi village was held on the 20 November 2021 at the office of the Kuruabahi Gaon Panchayat to mark the completion of the project and to apprize the users about arrangement of the Arsiron Nilogon chemical Kit and for knowing their feeling about the program.

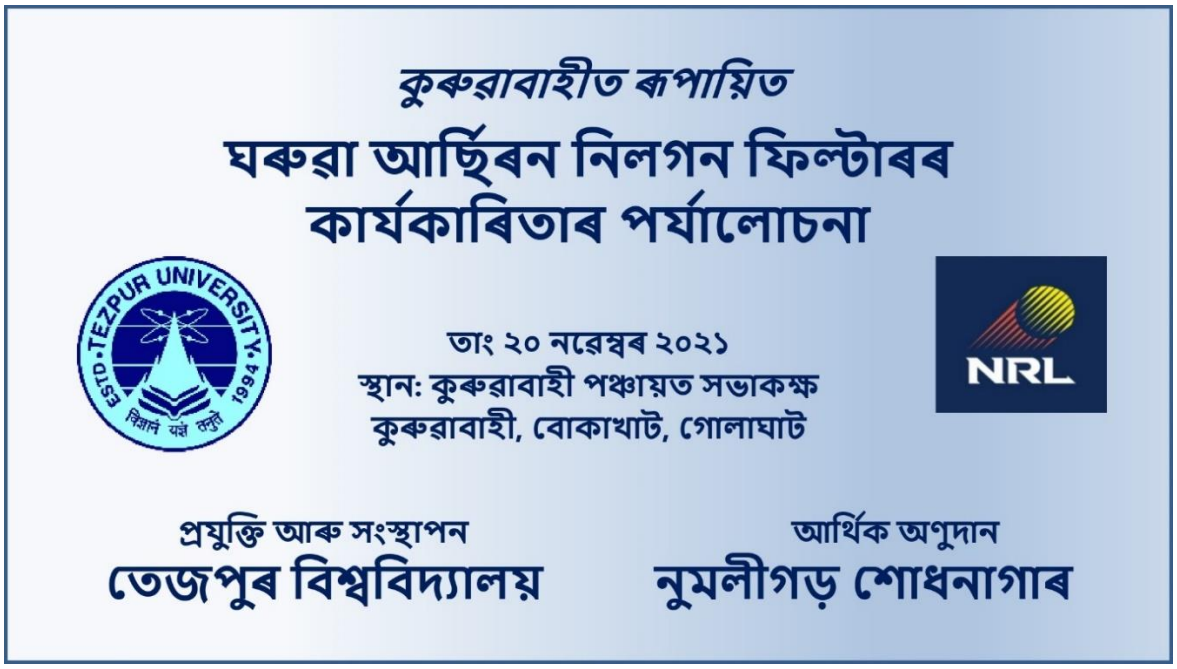


Figure 9: Banner of the concluding workshop on implementation of Arsiron Nilogon

A total of 80 people attended the workshop. The number of participants had to be restricted for covid protocols. There were twenty-five beneficiaries and six local volunteers including local ZPC and the president of Kurabahi Gaon panchayat in the meeting. The rest were from the adjacent Gaon Panchayat including some school teachers. The participants also included the presidents and members of the adjacent gram panchayat. The local ZPC made all arrangements for the event.

The Project Coordinator summarized the entire project and offered tanks for cooperation received from all villagers and the leadine people of the village in successful implementation

of the project. He also expressed his thankfulness to NRL for kind funding the project under its CSR program. The Coordinator once again explained the Arsiron Nilogon method to the participants and answered to several querries raised especially by the participants from neighbouring villages. He also apprized about the arrangements made for availability of the chemicals after the completion of the project.

Figure 10: The Project Coordinator, the local Gaon Panchayat President (Ms Rupa Bora), the local Zila Parishad Councilor (Mr. Sriram Das) and a user addressing the meeting on 20 Nov 2021 and Kuruabahi Gaon panchayat premise.

Some of the beneficiaries shared their experiences with a lot of gratitude for to team from Tezpur University and the NRL for providing arsenic-free drinking water to the villagers. They expressed happiness and satisfaction for finally getting a permanent solution to the drinking problem that they were facing for such a long time. A few even shared tragic events of losing their loved ones due to cancer in the past. Some of the people of the adjacent areas too spoke on the occasion. The local ZPC and the president of Kuruabahi Gaon Panchayat appreciated the project. Both of them specially thanked Prof. Dutta and the NRL for the project. The president expressed her happiness for being able to make the four habitations of Kuruabahi arsenic-free through Arsiron Nilogon. She also emphasised that the project should be expanded to the adjacent areas which are facing severe groundwater contamination of Arsenic. The teachers present there too spoke on the occasion. They expressed happiness after listening to the beneficiaries. They expressed hope that the program would be expapnded to their areas too in the near future. They also suggested on implementing Arsiron Nilogon in the arsenic -affected schools in the area. They also expressed their willingness to provide all necessary help if the same is implemented in their villages.

D.2: Arrangement for Sustainability
Availability of the Chemicals of Arsiron Nilogon Kit after the project

A stock of the chemicals will be maintained, at least for six months after completion of the project, at Kuruabahi with Mr. Narayan Das, a local volunteer from Chinakan 1, contact No. 6003622667. He along with Mr. Papumoni Hazarika will take care of the preparation and distribution of the chemicals. If any shortage is there, the Project Coordinator's group will do their best to take care of that. In the meantime, the Project Coordinator has been trying to make the chemicals available in a village shop in the area at reasonable price.

E. Conclusions and Recommendations

The pilot project has been implemented to the full satisfaction of the Department of Chemical Sciences, Tezpur University, in an unfavourable situation caused by COVID-19. The beneficiaries seem to be happy with the safe arsenic-free water from household Arsiron Nilogon filters. The arsenic-free water will save the villagers of the four habitations of Kuruabahi village from health problems caused by arsenic especially from deadly cancer.

The groundwater of the neighbouring villages of Kuruabahi, in fact, the most areas of Golaghat District are severely affected by Arsenic. Most of the schools in the district in general and in Kuruabahi area in particular, as revealed during this project work (**Table 4**), are also dangerously affected by groundwater arsenic used as drinking water. The NRL may take effective measures to solve these problems under its CSR program through implementation of Arsiron Nilogon technology.

Acknowledgement:

The Department of Chemical Sciences, Tezpur University, and the Project Coordinator sincerely thank Numaligarh Refinery Ltd. for generous and kind funding the pilot project under its CSR activity, and Tezpur University for administrative and accounting support. The Project Coordinator sincerely thanks the villagers of Kuruabahi, especially the leading local citizens and the local volunteers, for extending their helping-hand and the villagers for extending their full cooperation in implementation of the project. The Project Coordinator also thanks his PhD Students, namely, Ms. Tushmita Das, Mr. Shamiran Baroi, Mr. Saranga Baishya, Mr. Rituparna Saikia and Mr. Asadulla Asraf Ali for doing all the hard works in the field and the laboratory for successfull implementation of the project.

Signature:	(Robin Kumar Dutta)	(Ruli Borah)
Date: 4 March 2022	Project Coordinator & Professor	Head
Place: Tezpur	Dept. of Chemical Sciences	Dept. of Chem. Scs.
	Tezpur University	Tezpur University

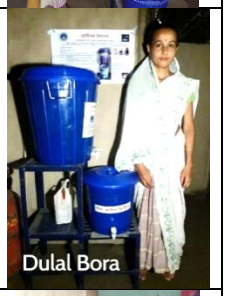
Annexure A:

Details of beneficiaries, arsenic test results of their drinking water before and after treatment, status, summary feedback and photographs of the household Arsiron Nilogon filters at all the 320 households of four habitations of Kuruabahi village.

Village	Sl. No.	Head of Family	No. of family members	Contact No.	Arsenic in ppb		Status	Feedback of user with signature / thumb print	Photograph of the filter with a beneficiary
					Before filtration	After filtration			
ChinakanNo. 1	1	Dadul Das	3	6000917389	332	Not Detectable	Working Used once daily	Satisfied	
	2	Bintu Das	4	Not Available	304	Not Detectable	Working	Satisfied	
	3	Raju Das	4	6003086467	194	Not Detectable	Working	Satisfied	
	4	Putu Das	4	6003086467	183	Not Detectable	Working	Satisfied	

	5	Puleen Bora	4	9101489442	**169**	Not Detectable	Working Used twice daily	Satisfied. Taste of water found better	
	6	Meera Bora	5	6900996288	**167**	Not Detectable	Working	Satisfied	
	7	Dimbeshwar Borah	4	6001910092	**166**	Not Detectable	Working	Satisfied	
	8	Gagan Rajkhowa	5	8011554459	**166**	Not Detectable	Working	Satisfied	
	9	Manju Baruah	4	8011554459	**166**	Not Detectable	Working	Satisfied	
	10	Pobin Das	4	8011574279	**143**	Not Detectable	Working	Satisfied	
	11	Pramod Rajkhowa	3	6001043060	**134**	Not Detectable	Working	Satisfied	

	12	Vimkanta Das	3	9864492278	113	Not Detectable	Working	Satisfied	
	13	Amal Borah	3	6002736263	99	Not Detectable	Working	Satisfied	
	14	Phuneshwar Borah	4	6001197822	99	Not Detectable	Working	Satisfied	
	15	Mamoni Das	2	8011574279	98	Not Detectable	Working	Satisfied	
	16	Monjit Das	4	8011574279	98	Not Detectable	Working	Satisfied	
	17	Rajib Das	5	8822508311	94	Not Detectable	Working	Satisfied	
ChinakanNo. 1	18	Satya Das	3	6000315137	94	Not Detectable	Working	Satisfied	

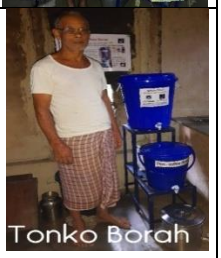
	19	Bilati Das	4	6000288417	93	Not Detectable	Working	Satisfied	
	20	Dulal Bora	3	6900996289	81	Not Detectable	Working	Satisfied	
	21	Akhil Saikia	4	9864380993	80	Not Detectable	Working	Satisfied	
	22	Mono Saikia	4	6900996288	80	Not Detectable	Working	Satisfied	
	23	Amiya Das	6	9365538362	79	Not Detectable	Working	Satisfied	
	24	Sambhu Das	4	9864136233	77	Not Detectable	Working	Satisfied	
	25	Babul Das	3	8133908963	77	Not Detectable	Working	Satisfied	

	26	Manju Ghatuwal	5	8133908963	77	Not Detectable	Working	Satisfied	
	27	Nirmal Das	3	9101720261	77	Not Detectable	Working	Satisfied	
	28	Jitul Das	4	6000085823	76	Not Detectable	Working	Satisfied	
	29	Rajib Bora	3	6001026118	76	Not Detectable	Working	Satisfied	
	30	Deepak Saikia	3	9864380993	74	Not Detectable	Working	Satisfied	
	31	Dhiren Das	5	9954735236	69	Not Detectable	Working	Satisfied	
	32	Ramen Borah	4	6001845589	64	Not Detectable	Working	Satisfied. Acidity problem is reduced	

	33	Pradip Rajkhowa	5	6002538647	**63**	Not Detectable	Working	Satisfied	
	34	Jitul Borah	4	9864155289	**55**	Not Detectable	Working	Satisfied	
	35	Sundari Borah	1	9864155289	**55**	Not Detectable	Working	Satisfied	
	36	Lolin Borah	4	9101489442	**55**	Not Detectable	Working	Satisfied. Finds the taste of water better.	
	37	Jayanta Rajkhowa	3	9954271244	**54**	Not Detectable	Working	Satisfied	
	38	Sarumai Rajkhowa	5	7002021571	**50**	Not Detectable	Working	Satisfied	
	39	Tanuram Borah	5	9678771918	**47**	Not Detectable	Working	Satisfied	

	40	Bhimkanta Saikia	5	6900996291	45	Not Detectable	Working	Satisfied	
	41	Rubul Borah	4	6003793890	45	Not Detectable	Working	Satisfied	
	42	Dulu Borua	4	6001652796	42	Not Detectable	Working	Satisfied	
	43	Putul Borah	5	8822870306	35	Not Detectable	Working	Satisfied	
	44	Bulu Das	2	6003540627	31	Not Detectable	Working	Satisfied	
	45	Lilimai Das	5	8011047592	30	Not Detectable	Working	Satisfied	
	46	Prafulla Borah	4	6001435376	25	Not Detectable	Working	Satisfied	

	47	Dhiren Bora	4	6001158113	25	Not Detectable	Working	Satisfied	
	48	Nitul Das	3	8011948804	23	Not Detectable	Working	Satisfied	
	49	Mahen Rajkhowa	6	9365488133	20	Not Detectable	Working	Satisfied	
	50	Upen Das	4	6001126641	19	Not Detectable	Working	Satisfied	
	51	Hiteswar Rajkhowa	5	8136053258	16	Not Detectable	Working	Satisfied	
	52	Phanidhar Borah	5	6001910092	14	Not Detectable	Working	Satisfied	
	53	Jitumani Bora	3	6003928375	14	Not Detectable	Working	Satisfied	

	54	Ranjit Das	5	8136052355	12	Not Detectable	Working	Satisfied	
	55	Kanuram Das	3	8136052355	12	Not Detectable	Working	Satisfied	
	56	Satya das	3	8011554459	12	Not Detectable	Working	Satisfied	
	57	Prabin Saikia	4	8011554459	12	Not Detectable	Working	Satisfied	
	58	Tonko Borah	5	9365538362	11	Not Detectable	Working	Satisfied	
	59	Umakanta Das	3	9365538362	11	Not Detectable	Working	Satisfied	
	60	Podumi Das	7	7896213177	10	Not Detectable	Working	Satisfied	

	61	Arun Das	4	6002597673	9	Not Detectable	Working	Satisfied	
	62	Indeswar Das	2	9954735236	9	Not Detectable	Working	Satisfied	
	63	Thaneswar Borah	6	6003461353	8	Not Detectable	Working	Satisfied	
	64	Mahendra Rajkhowa	5	8812913065	8	Not Detectable	Working	Satisfied	
	65	Dhaniram Das	5	6009737194	8	Not Detectable	Working	Satisfied	
	66	Tankeswar Borah	6	9365660271	6	Not Detectable	Working	Satisfied	
	67	Bubul Das	3	9365660271	5	Not Detectable	Working	Satisfied	

	68	Hemanta Das	3	8011052159	5	Not Detectable	Working	Satisfied	
	69	Ananta Das	4	7086507197	5	Not Detectable	Working	Satisfied	
	70	Dadul Das	4	9365416377	5	Not Detectable	Working	Satisfied	
	71	Moon Saikia	3	8133810779	4	Not Detectable	Working	Satisfied	
	72	Putali Saikia	5	8133810779	4	Not Detectable	Working	Satisfied	
	73	Muninda Saikia	4	6001417269	3	Not Detectable	Working	Satisfied	
	74	Gulap Saikia	3	6001417269	3	Not Detectable	Working	Satisfied	

	75	Narayan Das	5	6003622667	3	Not Detectable	Working	Satisfied	
	76	Manuram Das	6	8822004067	1	Not Detectable	Working	Satisfied	
	77	Manas Saikia	3	8822004067	1	Not Detectable	Working	Satisfied	
	78	Minedhar Borah	4	9864227292	Not Detectable	Not Detectable	Working	Satisfied	
	79	Mukhesar Rajkhowa	4	9864227292	Not Detectable	Not Detectable	Working	Satisfied	
	80	Digonta Rajkhowa	4	6001061985	Not Detectable	Not Detectable	Working	Satisfied	
	81	Muhan Rajkhowa	4	9864402971	Not Detectable	Not Detectable	Working	Satisfied	

	82	Atul Rajkhowa	6	8688040637	Not Detectable	Not Detectable	Working	Satisfied	
	83	Diganta Saikia	4	9101984945	Not Detectable	Not Detectable	Working	Satisfied	
	84	Dhaniram Saikia	6	7896589731	Not Detectable	Not Detectable	Working	Satisfied	
	85	Nobin Rajkhowa	5	6002615712	Not Detectable	Not Detectable	Working	Satisfied	
	86	Jibon Das	4	6003043831	Not Detectable	Not Detectable	Working	Satisfied	
	87	Gupal Das	5	9864699253	Not Detectable	Not Detectable	Working	Satisfied	
	88	Junaram Das	4	8133075171	Not Detectable	Not Detectable	Working	Satisfied	

	89	Babul Das	5	8011277422	Not Detectable	Not Detectable	Working	Satisfied	
	90	Muhon Das	4	6000694657	Not Detectable	Not Detectable	Working	Satisfied	
	91	Sanjib Das	4	6000694657	Not Detectable	Not Detectable	Working	Satisfied	
	92	Papu Das	3	8822792872	Not Detectable	Not Detectable	Working	Satisfied	
	93	Gulok Saikia	3	6001415578	Not Detectable	Not Detectable	Working	Satisfied	
	94	Nayan Gogoi	4	7086889987	Not Detectable	Not Detectable	Working	Satisfied	
	95	Puniram Das	8	8136053525	Not Detectable	Not Detectable	Working	Satisfied	

	96	Tubuki Das	5	9365402386	Not Detectable	Not Detectable	Working	Satisfied	
	97	Kamal Hazarika	6	9365721538	Not Detectable	Not Detectable	Working	Satisfied	
	98	Sorovai Das	4	8136052712	Not Detectable	Not Detectable	Working	Satisfied	
	99	Matia Das	6	9365721538	Not Detectable	Not Detectable	Working	Satisfied	
	100	Shuneshwar Das	4	6002121990	Not Detectable	Not Detectable	Working	Satisfied	
	101	Kousholya Das	5	6002121990	Not Detectable	Not Detectable	Working	Satisfied	
	102	Siben Das	4	6900361131	Not Detectable	Not Detectable	Working	Satisfied	

	103	Amrit Das	4	9707779495	Not Detectable	Not Detectable	Working	Satisfied	
	104	Nakul Das	7	8700612257	Not Detectable	Not Detectable	Working	Satisfied	
	105	Pabitra Das	4	7896589731	Not Detectable	Not Detectable	Working	Satisfied	
	106	Bubul Das	4	9707779498	Not Detectable	Not Detectable	Working	Satisfied	
	107	Rajib Das	3	6900780271	Not Detectable	Not Detectable	Working	Satisfied	
	108	Suneshwar Das	4	6900780271	Not Detectable	Not Detectable	Working	Satisfied	
	109	Golap Das	3	6001417269	Not Detectable	Not Detectable	Working	Satisfied	

	110	Kapahi Das	4	6001417269	Not Detectable	Not Detectable	Working	Satisfied	
	111	Dhiren Tamuli	3	6001417269	Not Detectable	Not Detectable	Working	Satisfied	
	112	Pankaj Saikia	5	8700612257	Not Detectable	Not Detectable	Working	Satisfied	
	113	Koli Barua	4	8136052712	Not Detectable	Not Detectable	Working	Satisfied	
	114	Probin Borah	5	6001061985	Not Detectable	Not Detectable	Working	Satisfied	
	115	Runumai Das	4	9707779495	Not Detectable	Not Detectable	Working	Satisfied	
	116	Babul Hazarika	3	7896589731	Not Detectable	Not Detectable	Working	Satisfied	

	117	Gonesh Saikia	4	7896589731	Not Detectable	Not Detectable	Working	Satisfied	
ChinakanNo. 2	118	Prafulla Das	5	6001417269	272*	Not Detectable	Working	Satisfied	
	119	Keteki Das	5	6001417269	272*	Not Detectable	Working	Satisfied	
	120	Luhai Das	5	6002641382	272*	Not Detectable	Working	Satisfied	
	121	Lakheswar Das	4	9365234412	158	Not Detectable	Working	Satisfied	
	122	Promilla Das	4	9365234412	158	Not Detectable	Working	Satisfied	
	123	Ram Das	4	6003093980	128	Not Detectable	Working	Satisfied	

	124	Bhupen Das	5	9678482807	128	Not Detectable	Working	Satisfied	
	125	Gulari Das	4	9365234412	92	Not Detectable	Working	Satisfied	
	126	Pravat Das	5	9365234412	92	Not Detectable	Working	Satisfied	
	127	Bejia Das	4	6001646337	92	Not Detectable	working	Satisfied	
	128	Pushpa Das	5	8811053310	91	Not Detectable	working	Satisfied	
	129	Sachindra Das	3	8811053310	91	Not Detectable	Working	Satisfied	
	130	Lalit Ghatuwal	4	9365234412	79	Not Detectable	Working	Satisfied	

	131	Ratul Das	5	9864970291	73	Not Detectable	Working	Satisfied	
	132	Buduram Das	3	Not available	73	Not Detectable	Working	Satisfied	
	133	Ramphosad Das	4	6901169071	61	Not Detectable	Working	Satisfied	
	134	Modhu Das	3	6901169071	60	Not Detectable	Working	Satisfied	
	135	Mohan Das	4	6000694657	55	Not Detectable	Working	Satisfied	
	136	Palash Das	4	6000694657	55	Not Detectable	Working	Satisfied	
	137	Hemkanta Das	4	8011052159	46	Not Detectable	Working	Satisfied	

	138	Rohit Das	3	8011948333	46	Not Detectable	Working	Satisfied	
	139	Dudul Das*	4	Not available	46	Not Detectable	Working	Satisfied	
	140	Rajib Das	3	8822508311	46	Not Detectable	Working	Satisfied	
	141	Kanaiti Das	5	7086723880	43	Not Detectable	Working	Satisfied	
	142	Ajay Das	3	9954541704	43	Not Detectable	Working	Satisfied	
	143	Bipul Das	3	9365109027	43	Not Detectable	Working	Satisfied	
	144	Suren Das	5	9101410997	43	Not Detectable	Working	Satisfied	

	145	Janeki Das	2	6002116675	43	Not Detectable	Working	Satisfied	
	146	Atul Das	4	9365510894	41	Not Detectable	Working	Satisfied	
	147	Krishna Das	5	9365510894	41	Not Detectable	Working	Satisfied	
	148	Profulla Das	4	6001435376	39	Not Detectable	Working	Satisfied	
	149	Hiren Das	4	8011944056	34	Not Detectable	Working	Satisfied	
	150	Mohendra Das	5	6003577510	25	Not Detectable	Working	Satisfied	
	151	Anil Das	3	6901513393	27	Not Detectable	Working	Satisfied	

	152	Basudev Das	5	6901513393	25	Not Detectable	Working	Satisfied	
	153	Khagen Das	2	6003570662	25	Not Detectable	Working	Satisfied	
	154	Jibon Das	6	7002156236	21	Not Detectable	working	Satisfied	
	155	Siteshwari Das	4	7002156236	9	Not Detectable	working	Satisfied	
	156	Budheshwar Das	2	7099722658	9	Not Detectable	Working	Satisfied	
	157	Bhulanath Das	5	7099722658	Not Detectable	Not Detectable	Working	Satisfied	
	158	Madho Das	4	9101609452	Not Detectable	Not Detectable	Working	Satisfied	

Adarsha Gaon	159	Ratul Das	3	9101609452	187*	Not Detectable	Working	Satisfied	
	160	Jayanta Das	4	7099722658	187*	Not Detectable	Working	Satisfied	
	161	Kushal Das	4	7099722658	187*	Not Detectable	Working	Satisfied	
	162	Tulu Das	4	Not available	91	Not Detectable	Working	Satisfied	
	163	Prodmadhar Das	4	9864120669	91	Not Detectable	Working	Satisfied	
	164	Nitul Das	4	8812809812	87	Not Detectable	Working	Satisfied	
	165	Dhanmani Das	3	6003146840	69	Not Detectable	Working	Satisfied	

	166	Ajit Setri	4	Not available	69	Not Detectable	Working	Satisfied	
	167	Radhesam Setri	3	Not available	69	Not Detectable	Working	Satisfied	
	168	Titou Setri	5	Not availablee	69	Not Detectable	Working	Satisfied	
	169	Dhiren Setri	4	7099722658	64	Not Detectable	Working	Satisfied	
	170	Jayanta das	3	7099722658	64	Not Detectable	Working	Satisfied	
	171	Sarulata Das	4	Not available	58	Not Detectable	Working	Satisfied	
	172	Amit Das	4	Not available	58	Not Detectable	Working	Satisfied	

	173	Mon Das	4	Not available	58	Not Detectable	Working	Satisfied	
	174	Simanta Das	3	Not available	58	Not Detectable	Working	Satisfied	
	175	Bimal Das	5	6003112245	53	Not Detectable	Working	Satisfied	
	176	Lakhiram Das	5	Not available	51	Not Detectable	Working	Satisfied	
	177	Budeshwar das	4	7099722658	36	Not Detectable	Working	Satisfied	
	178	Lakhiram Das	4	7099722658	9	Not Detectable	Working	Satisfied	
	179	Moniram Das	3	8638266997	9	Not Detectable	Working	Satisfied	

	180	Dhaniram Das	7	8638266997	2	Not Detectable	Working	Satisfied	
Singadoria	181	Baloram Das	7	6900361213	130*	Not Detectable	Working	Satisfied	
	182	Sonatan Das	4	6900849623	130*	Not Detectable	Working	Satisfied	
	183	Jiten Das	4	9365911644	130*	Not Detectable	Working	Satisfied	
	184	Dormi Das	4	7896680957	95	Not Detectable	Working	Satisfied	
	185	Moni Das	4	7896680957	95	Not Detectable	Working	Satisfied	
	186	Sunti Das	4	9365661881	68	Not Detectable	Working. Used twice daily	Satisfied	

	187	Punaram Das	9	9435641530	69	Not Detectable	Working	Satisfied	
	188	Digonto Das	4	6000343040	96	Not Detectable	Working	Satisfied	
	189	Bholanath Das	4	8822049718	96	Not Detectable	Working	Satisfied	
	190	Bilati Das	3	8638871970	74	Not Detectable	Working	Satisfied	
	191	Lakhan Das	3	8638871970	74	Not Detectable	Working	Satisfied	
	192	Dilip Das	3	8638871970	74	Not Detectable	Working	Satisfied	
	193	Moina Das	3	6002749558	55	Not Detectable	Working. Used twice daily	Satisfied	

	194	Bubul Das	5	7896957031	57	Not Detectable	Working	Satisfied	
	195	Punati Das	5	9864124606	57	Not Detectable	Working	Satisfied	
Singadoria	196	Madhab Das	5	6000584011	72	Not Detectable	Working	satisfied	
	197	Potibha Das	6	8638781914	70	Not Detectable	Working	satisfied	
	198	Luknath Borah	7	6000479085	66	Not Detectable	Working	Satisfied	
	199	Hiteshwar Das	7	9954729237	63	Not Detectable	Working	Satisfied	

	200	Prashanta Das	5	9954729237	63	Not Detectable	Working	Satisfied	
	201	Sanjib Das	3	9954729237	63	Not Detectable	Working	Satisfied	
	202	Ranjit Das	6	8638575221	72	Not Detectable	Working	Satisfied	
	203	Anil Das	4	6002108748	72	Not Detectable	Working	Satisfied	
	204	Niren Das	7	6900534980	72	Not Detectable	Working	Satisfied	
	205	Hemokanta Das	5	9365728919	89	Not Detectable	Working	Satisfied	
	206	Birenchandra Borah	4	8751070461	36	Not Detectable	Working	Satisfied	

	207	Upen Das	4	9707274799	36	Not Detectable	Working	Satisfied	
	208	Sabitri Das	3	8136053529	40	Not Detectable	Working	Satisfied	
	209	Dilip Das	4	9101582251	40	Not Detectable	Working	Satisfied	
	210	Bipul Das	4	6002192374	21	Not Detectable	Working	Satisfied	
	211	Bipul Das	5	8822460456	37	Not Detectable	Working Used twice daily	Satisfied	
	212	Rangili Das	3	8822460456	37	Not Detectable	Working	Satisfied	
	213	Sorulora Das	6	8638786105	10	Not Detectable	Working	Satisfied	

	214	Prabitra Borah	4	863864990	10	Not Detectable	Working	Satisfied	
	215	Ananta Hazarika	4	6001748911	19	Not Detectable	Working	Satisfied	
	216	Sriram Das	4	6001748911	1	Not Detectable	Working	Satisfied	
	217	Bhupen Das	4	6003221280	1	Not Detectable	Working	Satisfied	
	218	Pradip Das	5	6003221280	Not Detectable	Not Detectable	Working	Satisfied	
	219	Sanjay Borah	4	6003831795	Not Detectable	Not Detectable	Working	Satisfied	

	220	Basanta Hazarika	5	863858698	Not Detectable	Not Detectable	Working	Satisfied	
	221	Hemanta Hazarika	5	6002917608	Not Detectable	Not Detectable	Working	Satisfied	
Rongagora	222	Akoman Das		Not available	**167**	Not Detectable	Working	Satisfied	
	223	Bulu Das	5	6002917608	**176**	Not Detectable	Working	Satisfied	
	224	Komal Das	5	6002917608	**207**	Not Detectable	Working	Satisfied	
	225	Madhab Das	4	Not available	**207**	Not Detectable	Working	Satisfied	
	226	Nirmol Das	4	Not available	**187**	Not Detectable	Working	Satisfied	

	227	Bikash Chandan Das	5	Not available	**187**	Not Detectable	Working	Satisfied	
	228	Uttam Das	7	9365352151	**172**	Not Detectable	Working	Satisfied	
	229	Rajen Das	6	9577420435	**172**	Not Detectable	Working	Satisfied	
	230	Aobonti Das	5	8011948355	**159**	Not Detectable	Working	Satisfied	
	231	Mithun Das	4	8812840858	**216**	Not Detectable	Working	Satisfied	
	232	Lakhiram Das	5	9678458345	**216**	Not Detectable	Working	Satisfied	
	233	Nipul Das	8	6002469549	**269**	Not Detectable	Working	Satisfied	

	234	Robiram Das	4	8011837547	269	Not Detectable	Working	Satisfied	
	235	Gopal Das	3	8011837547	273	Not Detectable	Working	Satisfied	
	236	Jiten Das	4	9864110946	82	Not Detectable	Working	Satisfied	
	237	Bubul Das	6	7002258385	63	Not Detectable	Working Used twice daily	Satisfied	
	238	Swrnolota Das	1	8638181311	63	Not Detectable	Working	Satisfied	
	239	Bijit Das	3	7638044983	76	Not Detectable	Working	Satisfied	
	240	RajibDas	7	9864927639	76	Not Detectable	Working	Satisfied	

	241	Aaiti Das	6	9577420435	51	Not Detectable	Working	Satisfied	
	242	Jiten Das	2	9577420435	51	Not Detectable	Working	Satisfied	
	243	Ruhit Das	5	8011948333	89	Not Detectable	Working	Satisfied	
	244	Jibon Das	4	8473088951	95	Not Detectable	working	Satisfied	
	245	Sonti Das		8473088951	95	Not Detectable	Working	Satisfied	
	246	Nabakanto Das	2	9365421376	60	Not Detectable	Working	Satisfied	
	247	Lilakanta Das	4	6002963318	60	Not Detectable	Working	Satisfied	

	248	Bibhamoni Das	2	8471812371	70	Not Detectable	Working	Satisfied	
	249	Suren Das	3	9957626397	40	Not Detectable	Working	Satisfied	
	250	Lerela Das		9678458345	34	Not Detectable	Working	Satisfied	
	251	Jogot Das	7	6001578964	21	Not Detectable	Working	Satisfied	
	252	Horonath Das	5	7896121827	43	Not Detectable	Working	Satisfied	
	253	Anonto Das	5	8133908962	15	Not Detectable	Working	Satisfied	
	254	Narayan Das	6	Not available	39	Not Detectable	Working	Satisfied	

	255	Debojit Das	5	6900818065	344	Not Detectable	Working	Satisfied	
	256	Rahul Das	6	6901168791	28	Not Detectable	Working	Satisfied	
	257	Dilip Das	6	6003143764	28	Not Detectable	Working	Satisfied	
	258	Pranjyoti Das	4	690863101	28	Not Detectable	Working	Satisfied	
	259	Sobimai Das	5	8011089419	28	Not Detectable	Working	Satisfied	
	260	Chandrakanta Das	3	9864498412	49	Not Detectable	Working	Satisfied	
	261	Horen Das	4	9864182598	40	Not Detectable	Working	Satisfied	

	262	Protap Das	4	9864232740	44	Not Detectable	Working	Satisfied	
	263	Himeshwar Das	6	708689973	10	Not Detectable	Working	Satisfied	
	264	Anil Das	4	9957855495	10	Not Detectable	Working	Satisfied	
	265	Bilati Das	4	9365284168	7	Not Detectable	Working	Satisfied	
	266	Puhita Das	4	6900534747	6	Not Detectable	Working	Satisfied	
	267	Babu Das	2	6900534747	Not Detectable	Not Detectable	Working	Satisfied	
	268	Biren Das	7	6900534747	Not Detectable	Not Detectable	Working	Satisfied	

	269	Gulap Das	2	8136053884	Not Detectable	Not Detectable	Working	Satisfied	
	270	Promud Das	5	8761979827	Not Detectable	Not Detectable	Working	Satisfied	
	271	Gitanjoli Das	2	9864291558	Not Detectable	Not Detectable	Working	Satisfied	
	272	Ramnath Das	4	6003456970	Not Detectable	Not Detectable	Working	Satisfied	
	273	Bharoti Das	3	7635952152	Not Detectable	Not Detectable	Working	Satisfied	
	274	Bhobananda Das	4	6003458650	Not Detectable	Not Detectable	Working	Satisfied	
	275	Duramai Das	8	600270967	Not Detectable	Not Detectable	Working	Satisfied	

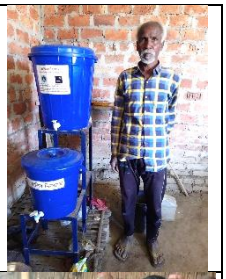
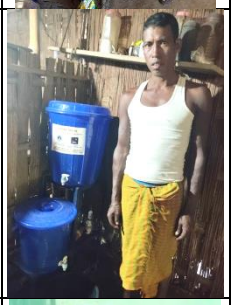
	276	Monikankana Das	5	600270967	Not Detectable	Not Detectable	Working	Satisfied	
	277	Noram Das	5	6001667618	Not Detectable	Not Detectable	Working	Satisfied	
	278	Bejia Das	4	6001667618	Not Detectable	Not Detectable	Working	Satisfied	
	279	Padma Das	2	8011948333	Not Detectable	Not Detectable	Working	Satisfied	
	280	Putul Das	8	6000869268	Not Detectable	Not Detectable	Working	Satisfied	
	281	Nareswar Das	2	6900534981	Not Detectable	Not Detectable	Working	Satisfied	
	282	Kanuram Das	4	6900996151	Not Detectable	Not Detectable	Working	Satisfied	

	283	Shahdeb Das	4	6001764841	Not Detectable	Not Detectable	Working	Satisfied	
	284	Tholok Das	5	9864131490	Not Detectable	Not Detectable	Working	Satisfied	
	285	Nandeswar Das	6	6000132627	Not Detectable	Not Detectable	Working	Satisfied	
	286	Upen Das	5	6900562691	Not Detectable	Not Detectable	Working	Satisfied	
	287	Dino Das	7	8822084451	Not Detectable	Not Detectable	Working	Satisfied	
	288	Nitul Das	5	8638236880	Not Detectable	Not Detectable	Working	Satisfied	
	289	Atul Das	1	8638236880	Not Detectable	Not Detectable	Working	Satisfied	

	290	Mina Das	4	986429220	Not Detectable	Not Detectable	Working	Satisfied	
	291	Satyajit Das	4	6003742575	Not Detectable	Not Detectable	Working	Satisfied	
	292	Nabajit Das	4	6900865784	Not Detectable	Not Detectable	Working	Satisfied	
	293	Katiya Das	4	6900996239	Not Detectable	Not Detectable	Working	Satisfied	
	294	Dinoram Das	7	9707429986	Not Detectable	Not Detectable	Working	Satisfied	
	295	Nalia Das	7	7099839081	Not Detectable	Not Detectable	Working	Satisfied	
	296	Dhiran Das	5	Not available	Not Detectable	Not Detectable	Working	Satisfied	

	297	Rita Rajkhuwa	4	Not available	Not Detectable	Not Detectable	Working	Satisfied	
	298	Pradip Das	4	Not available	Not Detectable	Not Detectable	Working	Satisfied	
	299	Jibon Das	5	Not available	Not Detectable	Not Detectable	Working	Satisfied	
	300	Dighola Das	4	6003420584	38	Not Detectable	Working	Satisfied	
	301	Sunia Das	4	6002184324	42	Not Detectable	Working	Satisfied	
	302	Dulal Das	4	9101609452	21	Not Detectable	Working	Satisfied	
	303	Ratul Das	4	9101609452	21	Not Detectable	Working	Satisfied	

	304	Ghunumai Das	3	Not available	21	Not Detectable	Working	Satisfied	
	305	Hemonta Das	4	6003044790	33	Not Detectable	Working	Satisfied	
	306	Gubin Das	5	8011368730	24	Not Detectable	Working	Satisfied	
	307	Vaiti Sabor	4	7002664949	20	Not Detectable	Working	Satisfied	
	308	Dimbo Das	1	Not available	20	Not Detectable	Working	Satisfied	
	309	Santush Ghatual	4	Not available	16	Not Detectable	Working	Satisfied	
	310	Ponaiti Sabar	6	Not available	16	Not Detectable	Working	Satisfied	

	311	Nandeshar Das	1	Not available	Not Detectable	Not Detectable	Working	Satisfied	
	312	Ramesh Das	4	Not available	Not Detectable	Not Detectable	Working	Satisfied	
	313	Suren Borah	6	Not available	Not Detectable	Not Detectable	Working	Satisfied	
	314	Nripen Das	4	8011948333	344	Not Detectable	Working	Satisfied	
	315	Mitharam Das	8	6001247950	177	Not Detectable	Working	Satisfied	
	316	Padum Das	3	Not available	216	Not Detectable	Working	Satisfied	

	317	Prasanta Das	5	7099745793	**115**	Not Detectable	Working	Satisfied	
	318	Babatu Das	4	7896949882	**320**	Not Detectable	Working	Satisfied	
	319	Jun Das	4	6001826639	**215**	Not Detectable	Working	Satisfied	
	320	Sitaram Bora	5	6000462472	**130**	Not Detectable	Working	Satisfied	
Total beneficiary: **Family = 320** **Population = 1355**									

*Some of the families are using water from a single common source tube well.

Signature:
Date: 4 March 2022
Place: Tezpur

(Robin Kumar Dutta)
Prroject Coordinator & Professor
Dept. of Chemical Sciences
Tezpur University

(Ruli Borah)
Prof. & Head
Dept. of Chem. Scs.
Tezpur University