

People's Committee of Ha Tinh Province  
People's Committee of Vinh Long Province

## Summary Report

The Socialist Republic of Vietnam

Pilot Survey for Disseminating  
Japanese SME's Technologies  
for  
Small-scale Safe Water Supply Project Using  
New Natural Inorganic Flocculant  
in Rural Areas

June, 2015

Japan International Cooperation Agency

HALVO, Ltd.

## **1. BACKGROUND**

People in the Socialist's Republic of Vietnam (hereafter simply called "Vietnam") have been keenly advancing rapid industrialization envisaging characteristic switchover from the conventional agricultural country and attracting foreign capital investors. On the other hand, environmental contamination is becoming an increasingly serious issue. Wastewater is not being handled with proper treatment; industrial wastewater and agricultural chemicals are flowing into ground water and river water that have been supporting residents' lives, resulting in water contamination becoming a nation-level issue. In addition, according to the Project for the Groundwater Development in Rural Part of Northern Provinces<sup>1</sup>, the diffusion of safe potable water in the rural areas remains as low as 20% so that sanitary problems due to the defective quality of drinking water and the contamination of raw water are being actualized, becoming the causes of diseases via water (diarrhea, eye trouble, skin disease, etc.)

Amidst the impetuous propulsion of industrialization - state's goal, raising the supply rates of safe water in the rural areas is becoming a challenge toward reducing ever-increasing gaps between regions and achieving a sustained development of the whole country.

## **2. OUTLINE OF THE PILOT SURVEY FOR DISSEMINATING SME'S TECHNOLOGIES**

### **(1) Purpose**

This survey aims to launch, with the local government taking a leading part, the small-scale and low-cost water purification business in the rural areas where less priority is placed by the central government on water purification treatment to realize a sustained supply of safe water to the poorest segment of the rural population, and to expedite reduction of the disparities existing in the social and living facets in Vietnam.

### **(2) Activities**

#### **1) Installation of water purification equipment and securing continual operation by local organizations**

##### **i. Manufacture of invested equipment**

Manufacturing and installation of the water purification equipment used under this survey were carried out in two times: September 2013 and February 2014.

The equipment invested and installed under this survey incorporated the following improvements compared with the time of the Feasibility Study<sup>2</sup>:

---

<sup>1</sup> Source: *External Valuation Report on the Project for the Groundwater Development in Rural Part of Northern Provinces* (External valuator: Global Link Management, Ltd.; Survey period: Dec., 2010 - Nov., 2011)

<sup>2</sup> "Project Formulation Survey" under the Governmental Commission on the Projects for ODA Overseas Economic Cooperation in FY2012

- At the time of Feasibility Study, only one type of equipment was used (capacity: 2 m<sup>3</sup>/h), whereas under this survey three types, namely: large, medium and small (this last manually operated), of water purification treatment equipment were manufactured in accordance with the demand for clean water in the respective areas.

- Contemplating long-term utilization (10 years or so) of the equipment, strength and quality enhancement was incorporated, such as change of water tank material from plastic to stainless steel.

- By rebuilding the tank for the medium-size equipment to a horizontally placed one, stability and safety in installation, and operation and maintenance were improved. (At the time of Feasibility Study a three-stage type tank was used)

- In order to satisfy the 06 Standard as the standard for water quality test, a triple activated carbon filter and an ultraviolet (UV) sterilizer were added to the medium-size water purification equipment.

Size-wise characteristics of the equipment are as follows:

- The small-size equipment is able to treat approx. 50 liters of raw water in one operation (about 15 min.) including water feed into and take out of the equipment. Although its clean water treatment capacity is not large, it can be operated manually by turning the hand-wheel and hence can be installed at the sites having no electricity supply or unsteady voltage. Since it weighs as small as approximately 60 kg, its displacement is easy and also suitable for use as emergency equipment in case of natural disasters, such as floods and typhoons.

- The medium-size equipment is able to treat approx. 500 liters of raw water in one operation (about 1 hour) including water feed into and take out. Although it involves use of electric power, its installation site just needs a compact space of an approximately 3 m x 3 m unit, so if it is flat and not likely exposed to rain and wind, its installation site can be selected easily and later relocation is possible as well.

- The large-size equipment has a water purification capacity of 5,000 liters / hour and can be operated continuously. A large quantity of raw water can be charged into this size equipment, so it is apt for the places that have a massive demand for treated water. Even though its utilization as a substitute for existing water cleaning facilities was assumed, its installation as such was not realized during the period of this survey.



**Figure 2-1 Small-Size Equipment (50 liters/time) and Medium-Size Equipment (500 liters/time)**



**Figure 2-2 Large-Size Equipment (5,000 liters/hour)**

**ii. Installation of water purification equipment**

On the basis of the list of candidate installation sites proposed by each Province, equipment installation sites were selected and agreed with the counterparts after having taken into consideration expected users, the kinds of raw water and its intake method, current clean water demand and future forecast, etc. The installations realized under this survey totaled 29 units comprising 13 small-size, 15 medium-size and one large-size, as shown in Table 2-1.

**Table 2-1 Breakdown of Equipment Installations**

	Province	Small-size (units)	Medium-size (units)	Large-size (units)	Total (units)
Confirmation / Preparation Phase (1st group)	Ha Tinh	5	6	0	11
	Vinh Long	7	3	0	10
	Subtotal	12	9	0	21
Verification Phase (2nd group)	Ha Tinh	0	4	1	5
	Vinh Long	1	2	0	3
	Subtotal	1	6	1	8
Total	Ha Tinh	5	10	1	16
	Vinh Long	8	5	0	13
	Subtotal	13	15	1	29

At the initial stage, the survey team planned to install in each Province 29 units of the small and medium size units and one large-size unit in each Province (namely totaling 58 of small and medium size and two of large-size for the two Provinces), but regarding the small and medium-size units, installation of a total of 28 units of these two size categories was eventually agreed with each Province due to the following reasons:

- At the first group installation, the number of medium-size equipment turned out to be larger than that of small-size equipment.
- It took costs to improve the equipment for the second group installation.
- The locations of installations were more dissipated than expected, for which it was judged difficult to install 29 units in each Province while adequately performing water quality tests and conducting operation and maintenance of the equipment.

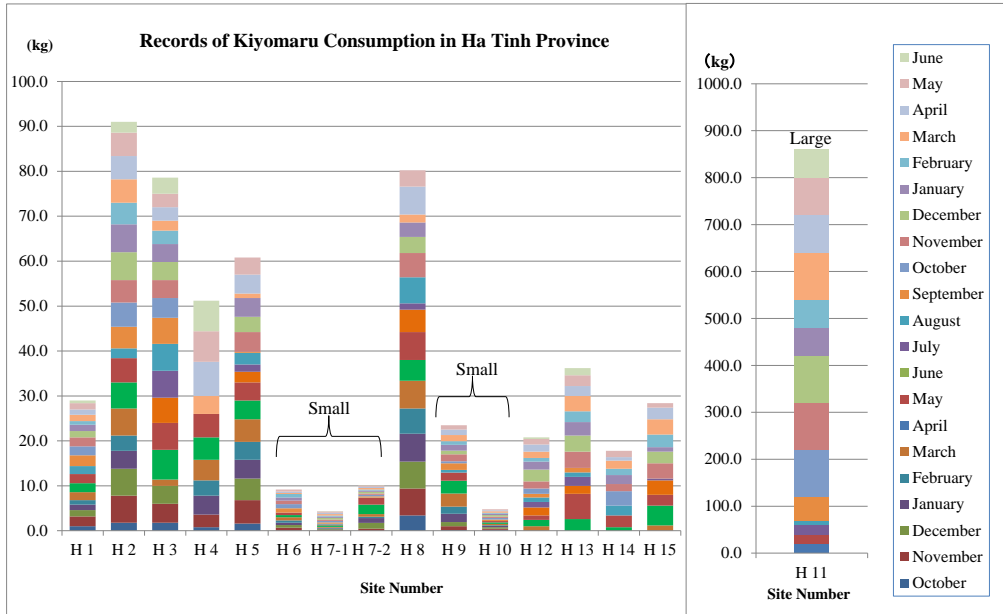
Regarding large-size equipment, the survey team also planned at the beginning to introduce one unit each of large-size equipment with a capacity of 10,000 liters/hour in Ha Tinh Province and Vinh Long Province, but it was agreed eventually with the respective counterparts to install one unit of the capacity of 5,000 liters/hour at the middle-scale public lodging house (pertaining to People's Committee and police) in Ha Tinh Province and none in Vinh Long Province.

### **iii. Operation of Equipment**

Regarding the operation and periodical cleaning of small, medium and large-size equipment, an operation and maintenance manual was prepared, based on which guidance was provided to local users anticipating their conducting smooth operation and periodical cleaning of the equipment.

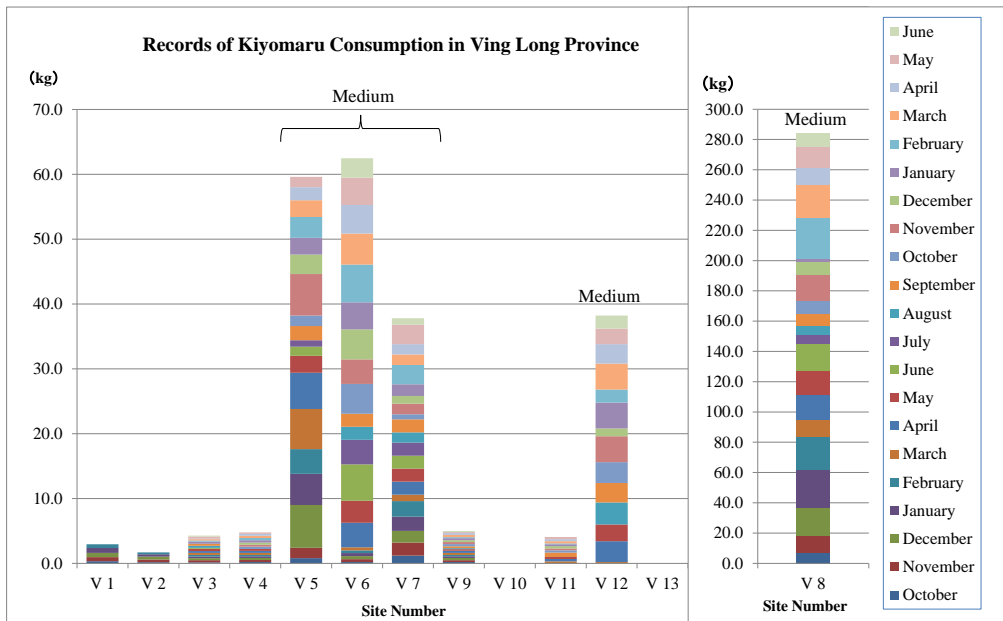
In terms of the utilization status of the equipment, the survey team requested each equipment user to keep

operation records (refer to Attachment No.2 for specimens), and on the basis of the register books, utilization rates and "HOH" consumption were grasped. "Kiyomaru" consumption under this project was as shown in Figure 2-3 and Figure 2-4 (For reference, since sterilization of water was also conducted in each equipment, the same quantity of "Disinfectant" was also used as explained in section 2,(3) Information of Product/ Technology to be Provided.)



\* The same quantity of "Disinfectant" has also been used.

**Figure 2-3 Consumption of Kiyomaru in Ha Tinh Province**



\* The same quantity of "Disinfectant" has also been used.

**Figure 2-4 Consumption of Kiyomaru in Ving Long Province**

## 2) Securing safety of treated water by conducting water quality test

### i. Use of treated water and applicable water quality standards

The water quality test was performed at QUATEST 3, a public organization specialized in chemical and environmental analysis which was established in Ho Chi Minh City in November 1994 by the ordinance of the Ministry of Science and Technology (as a sub-organization of the General Office of Standard, Measurement and Quality).

Under this survey, the use of treated water was classified into "Domestic Water," "Potable Water B" and "Potable Water A," of which the definitions and the kinds of required water quality standards valid in Vietnam are as follows:

**Table 2-2 Use of Treated Water and Applicable Water Quality Standards**

Purpose of Use	Definitions	Name of Standard	Number of items
Domestic Water	To be used as domestic water for washing clothes, cleaning (dusting, scrubbing, mopping), etc.	Domestic water standard: QCVN 02: 2009/BYT (02 Standard)	14 items
Potable water B	To be used for cooking and drinking (after boiling)	Potable water standard : QCVN 01: 2009/BYT (01 Standard)	109 items
Potable water A	To be directly drinkable as it is	Manufacturing and selling standard for bottled potable water: QCVN 6-1: 2010/BYT (06 Standard)	27 items

Potable Water A needs to satisfy 06 Standard and corresponding raw water to be treated as such has to clear 01 Standard. For this reason, in case raw water other than public service water (which satisfies 01 Standard) is treated, both 01 Standard and 06 Standard need to be satisfied by passing through relevant water quality tests.

### ii. Times of performing water quality tests

Water quality tests were conducted for a total of 257 samples comprising 143 in Ha Tinh Province and 114 in Vinh Long Province during the period from October 2013 to the end of May 2015.

### iii. Approval by the counterparts on the safety of treated water

In order to officially use "HOH Water," which has been limited to the use as domestic water, as potable water, it is necessary that official approvals be obtained on the safety of "HOH Water" in addition to on the safety of "HOH". For this reason, the survey team discussed particulars of the acquisition of official approvals from the counterparts for the safety of "HOH" and "HOH Water" on the basis of the results of water quality tests conducted at the third party water quality analysis organization, QUATEST 3.

To acquire official approvals on the safety of "HOH" and "HOH Water" from the counterparts is a crucial condition in order to secure the sustainability of this project.

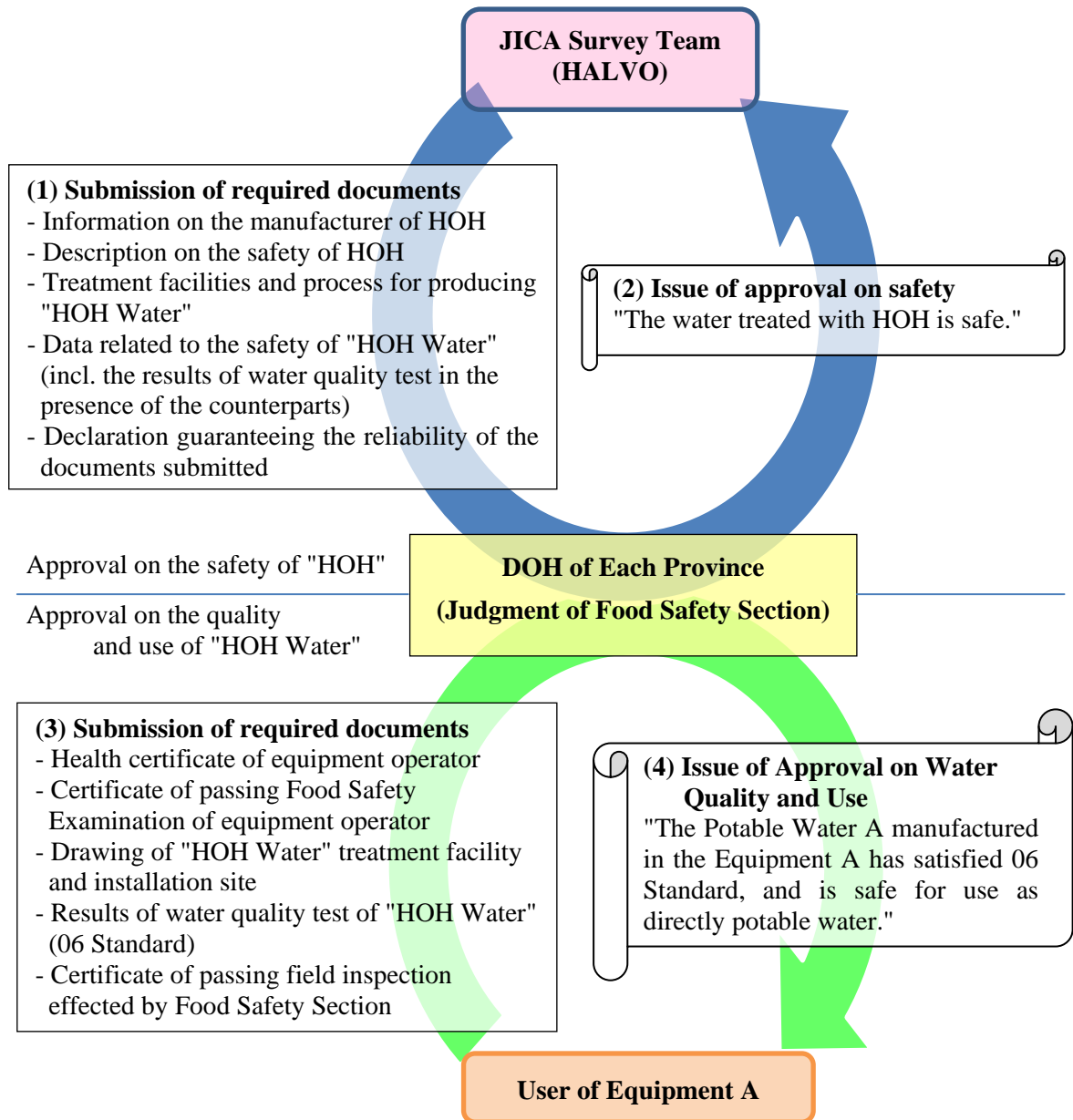
In Ha Tinh Province, repeated discussions were conducted with the counterpart before agreement was eventually reached on the procedure for obtaining an official approval on the safety of "Potable Water A" as shown in Figure 2-5. The procedure is split into two parts, namely the one corresponding to No. (1) and No. (2) for obtaining the approval on the safety of "HOH" to be issued to HALVO, and the other corresponding to No. (3) and No. (4) for the approval on the quality and use of "HOH Water" (Potable Water A) to be issued to each equipment user.

In the survey period, an approval on the safety of "HOH" was granted to HALVO on Feb. 12, 2015, and a total of five facilities have obtained approval on the quality of "HOH Water" and its use as "Potable Water A." (See Attachment No. 3 which shows specimen approvals on the safety of "HOH," and on the quality and use of "HOH Water")

Regarding "Domestic Water" and "Potable Water B," it was agreed with the counterpart and equipment users that the counterpart shall be present at the sampling procedure for the water quality test, and confirm that the results of the tests have satisfied the applicable water quality standard, but shall not issue such an official approval as that for "Potable Water A" and each equipment user shall use treated water at its responsibility.

As regards Vinh Long Province, agreement was reached with the counterpart that approvals are not to be issued in the same manner as in Ha Tinh Province and instead, water quality tests shall be conducted in the presence of DOH, and if its results have turned out to be satisfactory versus the applicable standards, then the use at the responsibility of equipment users of "HOH Water" shall be authorized to them. For reference, respective users are satisfied with the way agreed as above with the results of the water quality tests conducted in the presence of DOH satisfying the standards.





**Figure 2-5 Official Approval Procedures on the Safety of "Potable Water A" in Ha Tinh Province**

**3) Assuring self-reliant activities by local organizations and dissemination of water purification business through formulation of a commercialization plan**

**i. Method of studying formulation of a commercialization plan**

The objective of this survey is to launch the small-scale and low-cost water purification business in the rural areas (that are devoid of central government's preferential policy for clean water treatment), thereby supplying safe water continually to the poor segment of rural population.

From the viewpoint of small-scale but effective supply of safe water, a medium-size facility having a

capacity of 500 liters/time, unit-style and compact, being equipped with an UV sterilizer, with its treated water supported by the approval on the water quality and the use as directly potable water, has been judged to be the most suitable for the small-scale drinking water purification business.

Therefore, study was made on the organization management plan and financial analysis of the business (namely business feasibility valuation for an entrepreneur seeking to realize the small-scale water purification business that uses a medium-size facility), assuming the case of carrying on the said business to produce and supply potable water by using a medium-size facility and "HOH."

## **ii. Organization management plan for the rural areas**

Marketing of medium-size equipment shall be conducted by Clean Water Center (CWC) that is organized in the DARD of each Province, and its dissemination shall be put in practice, with CWC of each Province taking the central role, by aiming to purify drinking water and to maintain proper quality of potable water in the rural areas.

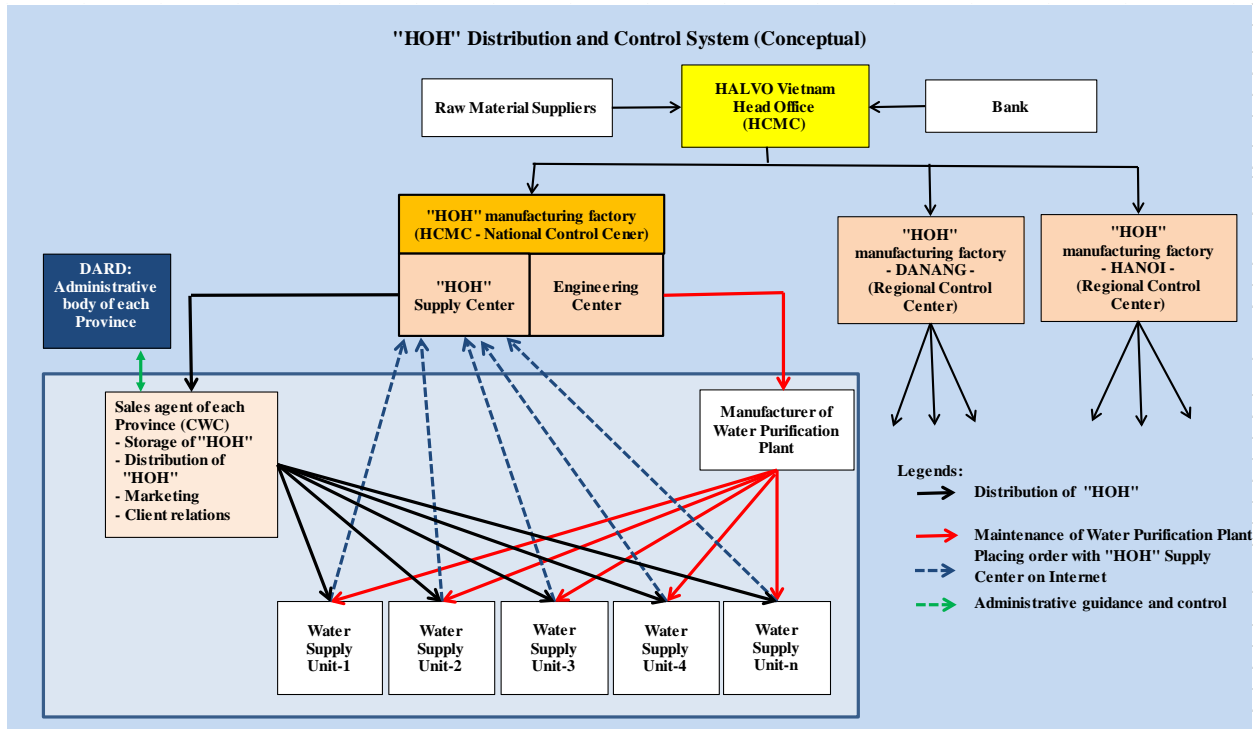
CWC of each Province will assume responsibly the distribution of "HOH" to be used for producing purified water. HALVO's supply center in Vietnam that receives orders will dispatch "HOH" in a lump to CWC, which in turn will distribute the received "HOH" to designated users. Further, CWC will periodically monitor utilization status of the equipment and provide guidance on the operation and maintenance of the equipment to its users. The manufacturers of the water purification equipment will carry out its periodical maintenance in accordance with the instructions of CWC.

As regards the operation and maintenance of the medium-size equipment, it is desirable that business units of communes play a central role to form a private-sector management organization. At forming such a management organization with investment of the private sectors, it becomes necessary that CWC of each Province take the lead to advance dissemination activities in each Province. To sell "HOH" alone is unthinkable and hence sale should be considered in linkage with the installation of medium-size equipment that utilizes "HOH."

Agreement was reached with the counterparts that sales agency in Ha Tinh Province and Vinh Long Province shall be assumed by CWC of each Province, which specifically will assume the following work:

- Exploration of new markets and dissemination of the small-scale water purification business
- Monitoring water quality related to the small-scale water purification business
- Surveillance of water analysis and water quality control
- Storage and delivery of "HOH"
- Collection of money from small-scale water purification entrepreneurs
- Payment to HALVO

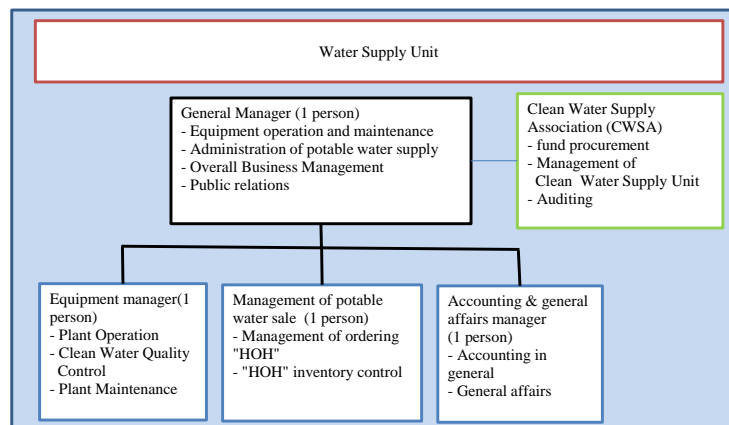
Figure 2-6 shows the organization chart of the whole of "HOH" distribution system.



**Figure 2-6 "HOH" Distribution and Control System**

The Water Supply Units - WSUs shown in the lowest part of Figure 2-6 represent the organizations that own and operate medium-size equipment, such as: People's Committees of the village part, publicly administered organizations (hospitals, schools, kindergartens, police, etc.) and commune-based People's Committees.

In the commune-based case, management of WSU will be conducted by Clean Water Supply Association - CWSA. The appointed WSU shall assume the operation and management of the equipment. Figure 2-7 provides the organization chart of Water Supply Unit.



**Figure 2-7 Organization Chart of Water Supply Unit**

**iii. Business financial analysis from the standpoint of Vietnamese small-scale water purification business entrepreneurs (Valuation of business feasibility)**

As a result of the business financial analysis from the standpoint of a Vietnamese small-scale water purification business entrepreneur, the Internal Rate of Return (IRR) turned out to be 10.1%, a level which exceeds the 5% of the standard interest rate of Vietnamese city bank. Since the investment repayment period is 6 years, the business can be judged as appropriate.

**(3) Information of Product/ Technology to be Provided**

Using natural inorganic flocculation / sedimentation agent "Kiyomaru" which is principally made from shirasu sand (volcanic ash of Sakurajima Island, Kagoshima Prefecture) and has been developed uniquely by HALVO and the "Disinfectant" which is principally made of chlorine, purification treatment of water originating from wells, springs, rivers and public waterworks is conducted by utilizing the facilities built in Vietnam. Under the present survey, "Kiyomaru" combined with "Disinfectant" are collectively called "HOH" and water treated as above "HOH water."



**Figure 2-8 "Kiyomaru" and "Disinfectant"**

**1) Features of products and technology**

"Kiyomaru" is characterized by the following: (a) offers a high-speed flocculation and sedimentation ability, enabling a significant reduction in the size of treatment equipment; (b) does not need to add flocculating aids, which results in less operational processes and facilitates dehydration and volume reduction of sediments; (c) Kiyomaru-using treatment equipment has an extremely simple structure, making it easy to install, to dismantle, to assemble and to transport; (d) enables equipment operators to engage in simple work only, such as monitoring of operation and charging of "Kiyomaru." Procurement and carrying in of "Kiyomaru" can be made with an ordinary vehicle. Furthermore, its powdery status facilitates packaging arrangement in line with the volume used for each time of treatment and the frequency of use; (e) flocculates harmful materials like heavy metals, and largely prevents re-elution of

the toxic substances from the precipitated sediments; (f) since its major raw material - sand also exists in Vietnam, its manufacturing costs can be reduced by realizing local production in Vietnam, which will contribute to the creation of factory employees, too.

## **2) Comparative advantages over competitors' products**

The following are the examples of comparing "Kiyomaru" with the products of competitors of the same industrial sector in and outside Japan: (a) In the water purification test that treated 10,000 ppm muddy water and coating wastewater in Japan, the charging volume of "Kiyomaru" could be reduced to as large as about 60% and 50%, respectively, of the quantities of the competitors' products required to get the same effects. This demonstrates that "Kiyomaru" has a higher cost-benefit advantage over others; (b) In the comparison with ordinary flocculation and sedimentation agent (aluminum sulfate) in Vietnam, "Kiyomaru" proved to flocculate and settle filthy river water at a speed approximately five times as high as that of the compared products, which means that it will squeeze operation hours and reduce the size of treatment equipment.

## **(4) Counterpart Organization**

People's Committee of Ha Tinh Province and People's Committee of Vinh Long Province, Vietnam

## **(5) Target Area and Beneficiaries**

Ha Tinh Province and Vinh Long Province, Vietnam

## **(6) Duration**

August 2013 to July 2015

## **(7) Progress Schedule**

The survey program was implemented in the below-mentioned four phases so as to obtain an effective and stabilized outcome. Work Flow is shown in Table 2-3.

- Basic matters concerning implementation of the survey were confirmed with the counterparts, and preparations were made for the Verification phase to be implemented next. The stage to cover all these activities corresponds to the Confirmation and Preparation phase (Aug. - Sep., 2013).

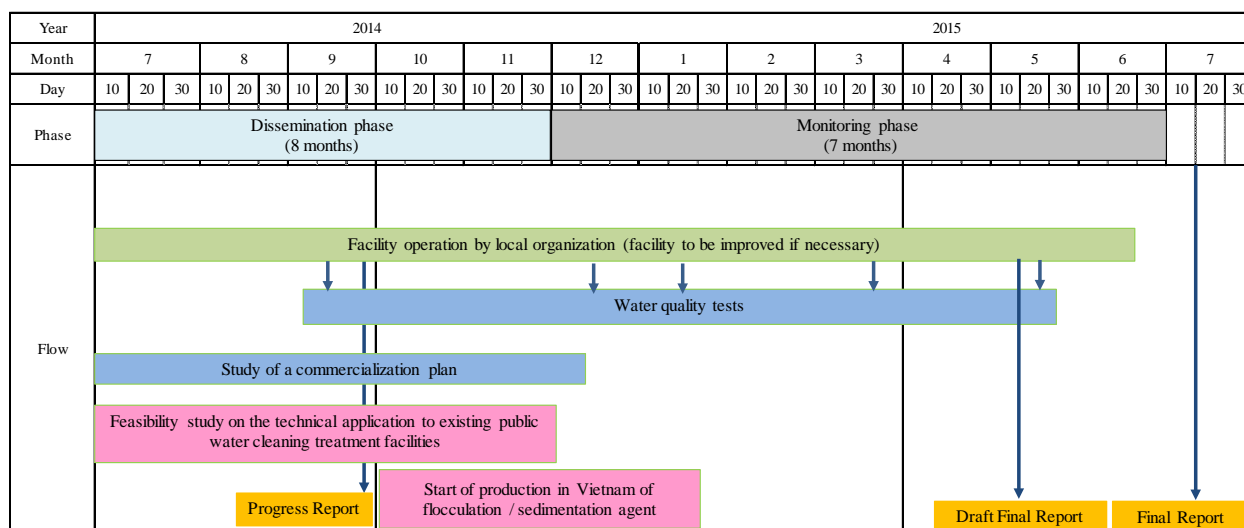
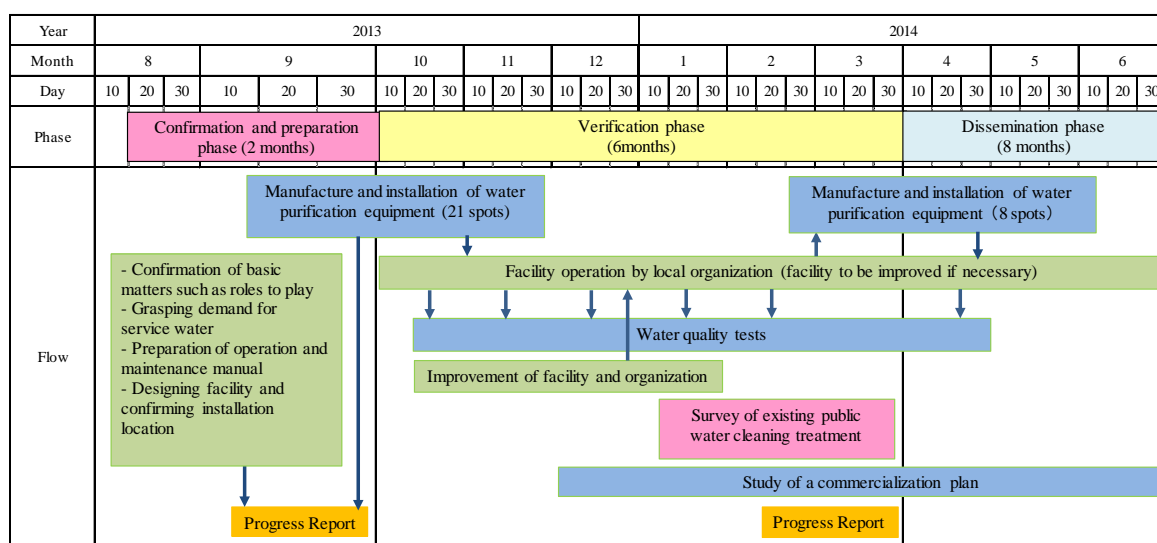
- The usefulness of the products and technology under the general conditions prevailing in the local areas was verified (target facilities: schools, hospitals and ordinary communities; target water sources: rainwater, river water and ground water). Then incorporation was made of local organizations required for sustained administration and operation of the water purification equipment. The stage to cover all these activities is the Verification phase (Oct., 2013 - Mar., 2014).

- Adaptability of the products and technology under the representative conditions was enhanced, and their

dissemination to larger scope and areas was sought. The stage to cover all these activities is the Dissemination phase (Apr. - Nov., 2014).

- While the status of operation, maintenance and technical aspects of the water purification business being implemented by the counterparts themselves was monitored for any problems, necessary assistance and supports for its further dissemination were extended. The stage to cover all these activities is the Monitoring phase (Dec., 2014 - Jun., 2015).

**Table 2-3 Work Flow**



## (8) Manning Schedule

The survey is being implemented by the order receiving company HALVO together with the external personnel from four companies.

**Table 2-4 Manning Schedule**

Work in charge	Name	Company name	2013												2014																				
			8			9			10			11			12			1		2		3		4		5		6		7		8			
			10	20	30	10	20	30	10	20	30	10	20	30	10	20	30	10	20	30	10	20	30	10	20	30	10	20	30	10	20	30	10	20	30
Confirmation and preparation phase			Verification phase						Dissemination phase																										
Survey Team Leader / Commercialization plan	Yoshiharu YAGYU	HALVO, Ltd.				30			3	17				19	0			3	9														0		
Chief Advisor / Summarize of survey	Koichiro HARADA	Japan Port Consultant, Ltd.				14			3	17				19	0			8	7															7	
Commercialization model	Tetsuo YOSHIDA	Japan Port Consultant, Ltd.							10																										
Organization and management plan	Isamu KOIKE	ACE Japan, Ltd.							14					3	15					8	7													3	7
Demand analysis	Takeshi SANADA	Japan Port Consultant, Ltd.				14														7															0
Facility planning / design	Masaru KASAHARA	OPC, Ltd.				19									10						7														3
Facility / water quality control	Akira FUJII	I-OFF Japan, Ltd.				14			20		0				8					7	0														0
Work coordination	Takuma TAKAHASHI	Japan Port Consultant, Ltd.				14			3	10											8														

Work in charge	Name	Company name	2014							2015							MM																					
			9		10		11		12		1		2		3		4		5		6		7		VN	JP												
			10	20	30	10	20	30	10	20	30	10	20	30	10	20	30	10	20	30	10	20	30															
Monitoring phase																																						
Survey Team Leader / Commercialization plan	Yoshiharu YAGYU	HALVO, Ltd.	30	0				0																												4.03	0.80	
Chief Advisor / Summarize of survey	Koichiro HARADA	Japan Port Consultant, Ltd.	0	0	15				6				6	3						4																3.33	0.80	
Commercialization model	Tetsuo YOSHIDA	Japan Port Consultant, Ltd.																																			0.46	
Organization and management plan	Isamu KOIKE	ACE Japan, Ltd.	3	11	2	15			6																												2.57	0.80
Demand analysis	Takeshi SANADA	Japan Port Consultant, Ltd.	7																																		1.23	
Facility planning / design	Masaru KASAHARA	OPC, Ltd.	7						4																												1.93	
Facility / water quality control	Akira FUJII	I-OFF Japan, Ltd.	6			6		4																													3.40	
Work coordination	Takuma TAKAHASHI	Japan Port Consultant, Ltd.	5			7																															1.83	0.80
																											Order receiving company		Man-Months	4.03	0.80							
																											Exterior collaborators		Man-Months	14.75	2.40							
																											Total Man-Months		18.78	3.20								

Legend

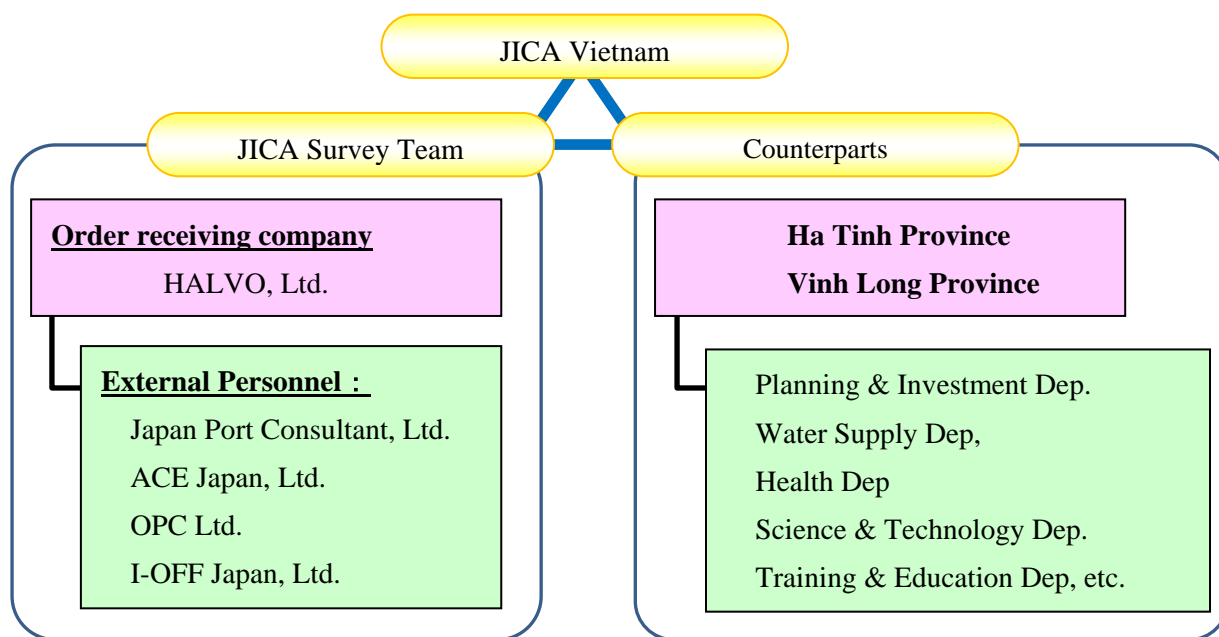
- In Vietnam
- In Japan

## (9) Implementation System

The implementation system of the survey is a tripartite system principally comprising JICA Survey Team, the counterparts and JICA Representative in Vietnam.

JICA Survey Team is composed of the order receiving company HALVO and external personnel from four companies; the counterparts consist of the Department of Agriculture and Rural Development, Dept. of Planning and Investment, Dept. of Service Water Supply, Dept. of Health Care, Dept. of Technology and Science, Dept. of Training and Education, etc.

The survey implementation system by the three major parties is shown in Figure 2-9.



**Figure 2-9 Survey Implementation System**

### **3. ACHIEVEMENT OF THE SURVEY**

#### **(1) Outputs and Outcomes of the Survey**

##### **1) Installing water purification equipment and securing continual operation by local organizations**

The number of water purification facilities installed during the survey period has totaled 29 as shown in Table 2-1 and Attachment No.4.

At many of the installation sites, the equipment was used once each day, or in the extreme case seven times a day, besides continual utilization as well.

This is as a result of the deepening of the understanding by the users of the equipment operation supported by the operation manual on top of the high operability of the equipment, and their reposing trust in the safety of "HOH Water" which owed to the appropriate operation and maintenance carried out under the guidance provided by the Survey Team during the survey period. The users (in particular, the low-income bracket that had so far not been able to make daily use of clean drinking water) are quite satisfied with "HOH Water" and the equipment quality, they are expressing their intention to continue to produce "HOH Water" by purchasing "HOH" at their own expense and utilizing the same equipment.

From the above, all water purification facilities are deemed to have been appropriately located and continual operation by the local users will continue to be assured further.



## 2) Assuring the safety of treated water by performing water quality tests

In order to use treated water as directly potable water, two approvals are required: the one on the safety of "HOH" to be issued by each Province's DOH to HALVO, and the other on the water quality and use of "HOH Water" (as Potable Water A) issued by each Province's DOH to respective equipment users.

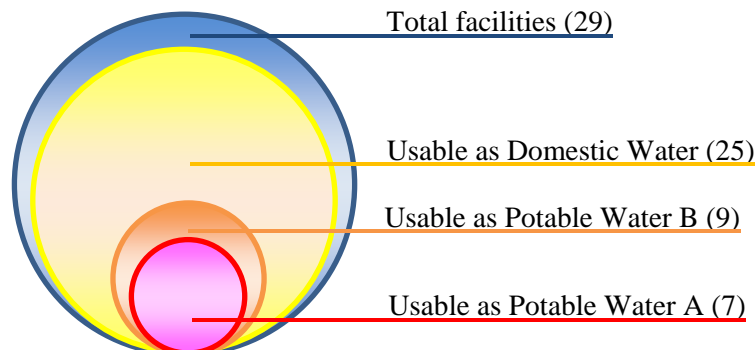
In Ha Tinh Province, an approval dated Feb. 12, 2015 on the safety of "HOH" was issued by DOH of Ha Tinh Province to HALVO, which was a significant outcome from the point of view of safety assurance.

As regards the approval on the water quality and use of "HOH" (as Potable Water A), four users in Ha Tinh Province whose facilities had satisfied the prescribed water quality standard (06 Standard) have been granted relevant approval. The fact that approval on the quality and use of "HOH water" (as Potable Water A) was issued means that the safety of "HOH water" has been proven in Vietnam and recognized by the public establishments such as People's Committee. This is expected to accelerate its diffusion not only to equipment users but also in the supply of "Potable Water A" to neighbors in the future.

Having acquired official approvals in Ha Tinh Province and established the approval obtaining procedures, it can be regarded as the achievement of the most important objective for assuring the sustainability of the water purification business.

In Vinh Long Province, agreement was reached with the counterpart that different from Ha Tinh Province an official approval obtaining procedure was not required, however since users are sufficiently satisfied with the way to have the results of water quality tests achieve the applicable standards, the safety of "HOH Water" has been sufficiently recognized in Vinh Long Province.

At completing this survey, the number of facilities that have achieved the targeted water quality standards by application was 17 out of the total 29 facilities, of which the facilities that can offer treated water that can be used at least as "Domestic Water" reached as large as 25. It is necessary to consider future use of part of the facilities including possible displacement or relocation of the facilities that cannot satisfy the required standards, but a degree of achievement of the primary objective is deemed to have been realized throughout this survey.



This is the outcome that will largely contribute to the increase in the supply of safe water to the poor rural people being unable to enjoy the diffusion of public water supply development projects led by the central government, and the reduction of regional disparities by dint of the improvement of living environment.

In addition, "HOH water" that has achieved the 06 Standard can not only be used by the users but also be sold to markets. Future commercialization in the regions of producing "HOH water" with the medium-size equipment is consequently expected to create job opportunities and earning increase in favor of the poor segment of the regional population.

Table 3-1 shows the achieving status of the applicable water quality standards of each facility and achievement status for target water quality standards by application.

**Table 3-1** Achieving Status of Applicable Water Quality Standards of Each Facility and Achievement Status for Target Water Quality Standards by Application

Province	Site No.	Size	Raw Water	Target Application <span style="background-color: yellow;">    </span> and Achievement Status of Water Quality Tests (○)			Achievement Status of Water Quality Test for Target Application
				Domestic Water	Potable Water B	Potable Water A	
HT	H1	Medium	Tap water	○	○	○	○
	H2	Medium	Shallow well	○			
	H3	Medium	Deep well	○			
	H4	Medium	Deep well				
	H5	Medium	Deep well	○	○	○	○
	H6	Small	Shallow well	○			○
	H7-1	Small	Shallow well	○			○
	H7-2	Small	Shallow well	○			○
	H8	Small	Tap water	○	○	○	○
	H9	Small	Tap water	○	○	○	○
	H10	Small	Tap water	○	○	○	○
	H11	Large	Shallow well	○			○
	H12	Medium	Shallow well	○			
	H13	Medium	Spring Water	○			○
	H14	Medium	Tap water	○			
H15	Medium	Shallow well	○			○	
VL	V1	Small	Tap water				
	V2	Small	Tap water				
	V3	Small	River Water	○			○
	V4	Small	Tap water	○			
	V5	Medium	River Water	○	○	○	○
	V6	Medium	River Water	○	○		
	V7	Medium	River Water	○	○		○
	V8	Medium	River Water	○	○	○	○
	V9	Small	Tap water	○			
	V10	Small	Tap water	○			
	V11	Small	River Water	○			○
	V12	Medium	River Water	○			○
	V13	Small	River Water				
Total	Ha Tinh Province			15/16	5/9	5/9	11/16
	Vinh Long Province			10/13	4/9	2/3	6/13
				25/29	9/18	7/12	17/29

Remarks:

Target Application and Achievement Status of Water Quality Tests: Yellow-colored cells show target

application(s) of each facility and ○ means that the relevant water quality tests have been satisfied.

Achievement status of Water Quality Test for Target Application: ○ means that all the water quality tests of the application(s) (colored in orange) targeted by the facility have been satisfied.

Total: Total number of facilities that have satisfied the water quality tests / Total number of facilities that have set the targeted applications during the survey period.

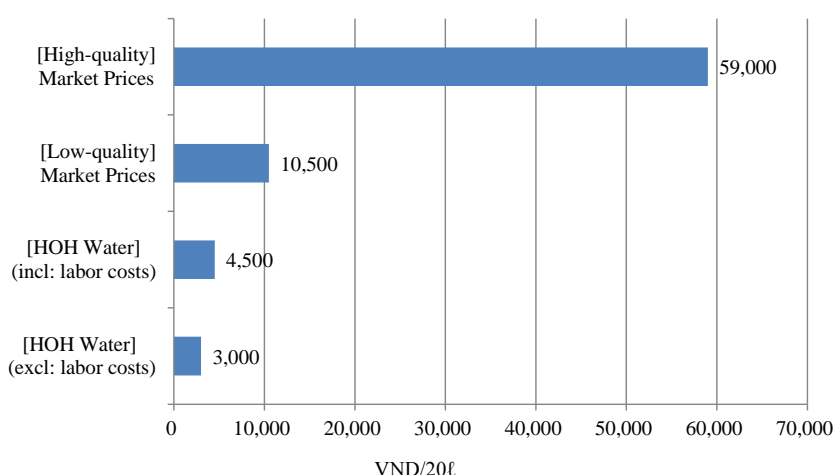
As for the outlines of respective Site Nos. H1 to V13, refer to Attachment No. 4.

### 3) Assuring self-reliant activities by local organizations and dissemination of water purification business through formulation of a commercialization plan

As mentioned in the paragraph of business financial analysis from the standpoint of Vietnamese small-scale water purification business entrepreneurs, the small-scale water purification business using medium-size equipment has been confirmed as appropriate financially.

Furthermore, in the present assumption, the sale of "HOH Water" at 4,500 VND/20L (including labor costs, and equivalent to 43% of 20L bottled low-quality potable water on the market) was also confirmed feasible. With the price level as low as 43% of the 20L bottled low-quality potable water on the market, "HOH Water" has water quality equivalent to the level of high-quality water being sold on the market.

In case the equipment is operated by a public facility staffer of People's Committee, no involvement of labor cost is expected so that water treatment costs can be reduced accordingly. The selling price of "HOH Water" under this premise will come to 3,000 VND/20L, or compressed to only 29% of the 20L bottled low-quality potable water on the market. This unitary price can be applied to the poorer segment of the residents as a preferential rate.



\* In Vietnam, a small number of foreign-affiliated firms are marketing "high-quality" potable water that satisfies the potable water standard. In the meantime, a large number of companies are reportedly selling "low-quality" potable water that does not satisfy the relevant standard.

**Figure 3-1 Price Comparison between "HOH" under the Survey and Others on the Market**

Furthermore, since consents of both counterparts have been obtained to the organization chart in Figure 2-6 which concerns the organization plan of the commercialized business, self-reliant activities by the local organizations are deemed to have been assured and the base for the dissemination of the business has been established.

## **(2) Self-reliant and Continual Activities to Be Conducted by Counterpart Organization**

With regard to the management organizations, agreement has been reached with the counterparts in terms of the proposed organization chart of distribution and control system (See Figure 2-6). The financial analysis conducted for the small-scale water purification business has confirmed that investment should be financially viable from the standpoint of both the small-scale water purification business entrepreneurs and HALVO.

Furthermore, decision has been made that at the termination of this survey, the water purification facilities shall be transferred by JICA to each Province, and operation and control of the same facilities shall be thereafter entrusted to respective users in official writing. Besides, future supply prices of "Kiyomaru" have been agreed upon with each Province.

From the above, assurance is deemed to have been made for the base of the continued self-reliant activities by the governmental organizations of the surveyed country following the termination of this survey program.

## **4. FUTURE PROSPECTS**

### **(1) Impact and Effect on the Concerned Development Issues through Business Development of the Product/ Technology in the Surveyed Country**

In Vietnam water contamination associated with the rapid industrialization of recent years is becoming a nation-level issue. In addition, the diffusion of safe potable water in the regions remains as low as 20% and hence sanitary problems due to the defective quality of drinking water and the contamination of raw water are being actualized, thereby causing diseases via water (such as diarrhea, eye trouble, skin disease).

Continued dissemination of HALVO's products throughout Vietnam will contribute to the purification of water sources being contaminated by industrial wastewater and agricultural chemicals, etc. that are on the rise along with the economic development of the country. Besides, it will also promote increasing supply of safe and secure drinking water and domestic water particularly to the rural areas that are suffering shortage of public water supply systems. These will not only improve people's living environment and enhance diffusion of safe drinking water supply, but also will solve health hazard.

There are a large number of developing countries that are, the same as Vietnam, holding issues in terms of safe water supply in the regional areas. The knowhow acquired through this survey will also contribute

to solving the challenges faced by those countries.

## **(2) Lessons Learned and Recommendation through the Survey**

For the duration of 2 years, JICA Study Team has been carrying out with cooperation from the counterparts the dissemination and verification survey of the small-scale water purification business that uses the eco-friendly natural inorganic flocculation agent developed by HALVO with its unique technology. As a result, it has been verified that because of its excellent water purification ability, "HOH" can produce safe water (as domestic water and potable water) from river water and ground water possibly contaminated with mud, e.Coli, iron, or even arsenic, etc. In addition to the safety, financial analysis has also confirmed the viability of the small-scale water purification business that uses "HOH."

At completing this survey and proceeding to the stage of continuing the "HOH"-based small-scale water purification business, JICA Study Team is pleased to recommend and suggest the following:

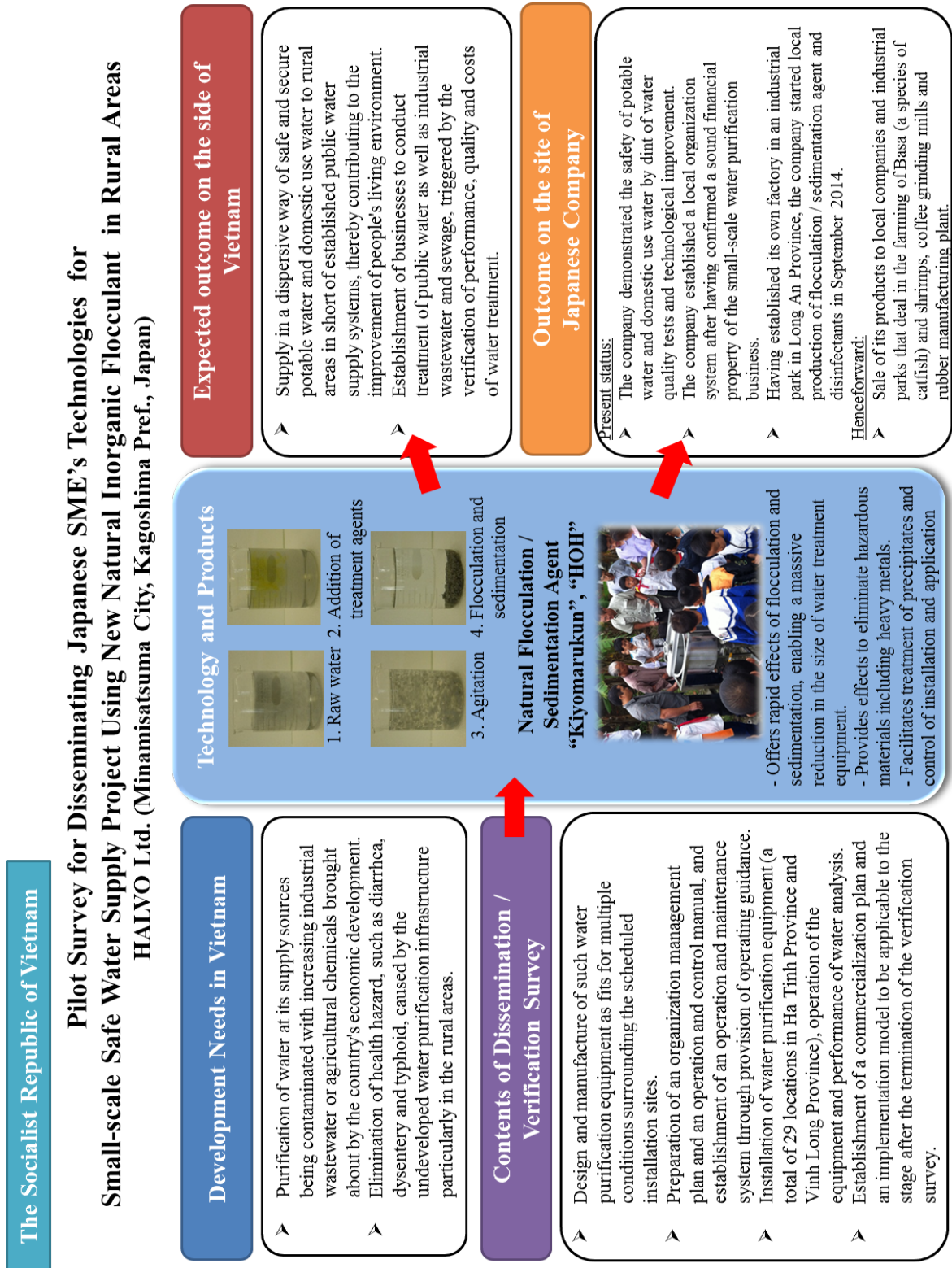
- To expressively position this business within the Province-level Master Plan scope of a clean water treatment and supply project, thereby materializing organization of continual business operating system, formulation of working schedule and budgeting.
- To promote establishment of an assistance system to be subsidized by either Province or the central government assuming that the small-scale water purification business is being operated in the public facilities, such as schools and hospitals in the regional areas that are not supplied with public water on schedule.
- To continue to expand business development activities in conjunction with HALVO not only to public facilities but also to the water purification and supply business to be taken up by the private sectors.
- Although the safety of "HOH water" has been confirmed under this survey, it is subject to the appropriate operation and maintenance of the water purification equipment. Therefore, in case remarkable changes have come out in the quality of raw water or treated water, necessary improvement of the facilities and "HOH" is to be implemented in continued cooperation with HALVO. In addition, people in charge of quality control in the working site are to strictly abide by the requirements of HALVO.
- The sediments from the present small-scale water purification treatment have been confirmed as not hazardous and of a small quantity. However, in case large-scale water treatment is put in practice in the future, the method of its disposal will be studied, and necessary permission of the competent authorities be obtained in case necessary.
- In case a new facility is manufactured and installed, sufficient considerations shall be paid to the safe operating conditions that contemplate surrounding environment and also to the point that the new facility can be operated easily by women and elderly people.

ATTACHMENT No.1: OUTLINE OF THE SURVEY

ATTACHMENT No.2: Operation Records

ATTACHMENT No.3: Specimen Approvals on the Safety of "HOH," and on the Quality and Use of  
"HOH Water"

ATTACHMENT No.4: Outlines of Respective Site



ATTACHMENT No.2: Operation Records

Biên bản vận hành (500L) tại ( Tuồng THPT Nguyễn Huệ ) (1-15)

Tháng: 12 Năm: 2013

1. Biên bản tiêu thụ

Ngày	Nguồn nước thô	Vận hành thiết bị		Lượng HOH sử dụng		Mục đích sử dụng nước	Ghi chú
		Mé (Lần)	Thời gian (phút/mé)	A (Kiyomaru) (gói/mé)	B (Chlorine) (gói/mé)		
1	/	/	/	/	/	/	/
2	/	/	/	/	/	/	/
3	/	/	/	/	/	/	/
4	Nước giếng	1	15'	1	1	vận hành máy	Nước bình thường
5	"	1	15'	1	1	"	" Rữa máy
6	"	1	15'	1	1	"	Nước bình thường
7	"	1	15'	1	1	"	"
8	/	/	/	/	/	/	/
9	Nước giếng	1	15'	1	1	vận hành máy	Nước bình thường
10	"	1	15'	1	1	"	"
11	"	1	15'	1	1	"	" Rữa máy (mức BT)
12	"	1	15'	1	1	"	Nước bình thường
13	"	1	15'	1	1	"	"
14	"	1	15'	1	1	"	Rữa máy (mức BT)
15	/	/	/	/	/	/	/
16	Nước giếng	1	15'	1	1	vận hành máy	Nước bình thường
17	"	1	15'	1	1	"	"
18	"	1	15'	1	1	"	"
19	"	1	15'	1	1	"	" Rữa máy
20	"	1	15'	1	1	"	Nước bình thường
21	"	1	15'	1	1	"	"
22	/	/	/	/	/	/	/
23	Nước giếng	1	15'	1	1	vận hành máy	Nước bình thường
24	"	1	15'	1	1	"	"
25	"	1	15'	1	1	"	"
26	"	1	15'	1	1	"	"
27	"	1	15'	1	1	"	" Rữa máy
28	"	1	15'	1	1	"	"
29	/	/	/	/	/	/	/
30	Nước giếng	1	15'	1	1	vận hành máy	Nước bình thường
31	"	1	15'	1	1	"	"

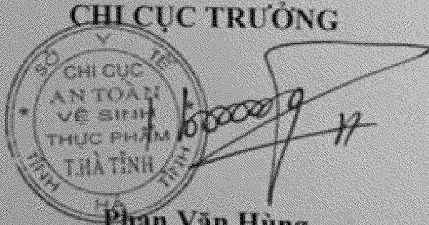
2. Biên bản cung ứng

HOH được cung cấp	Ngày	Khối lượng được cung cấp trong tháng (gói)	Lượng còn lại trong tháng (gói)
A (Kiyomaru)	4/12/2013	80	0
B (Chlorine)		30	6

*[Signature]*  
Đoàn Thị Xuyên

3. Chú thích



SỞ Y TẾ HÀ TĨNH CHI CỤC AN TOÀN VỆ SINH THỰC PHẨM	CỘNG HÒA XÃ HỘI CHỦ NGHĨA VIỆT NAM <u>Độc lập – Tự do – Hạnh phúc</u>
Số: 35/2015/YTHT-TNCB	Hà Tĩnh, ngày 12 tháng 02 năm 2015
<b>GIẤY TIẾP NHẬN BẢN CÔNG BỐ HỢP QUY</b>	
<b>Chi cục An toàn vệ sinh thực phẩm Hà Tĩnh xác nhận đã nhận Bản công bố hợp quy của:</b>	
<i>Tên tổ chức, cá nhân:</i> Dự án cấp nước an toàn quy mô nhỏ sử dụng chất keo tụ vô cơ thiên nhiên cho khu vực nông thôn của tổ chức JAICA - Nhật Bản	
<i>Địa chỉ:</i> Halvo Ltd, số 11675- Kaseda Uchiyamada, Minamisatsuma-shi, Kagoshima, 897-0004, Japan.	
<i>Điện thoại:</i> +81.993-52-4130 ; <i>Fax:</i> +81.993-53-8560	
<i>E-mail:</i> <a href="mailto:yagyu@kiyomarukun.jp">yagyu@kiyomarukun.jp</a>	
<b>Cho sản phẩm:</b> Nước uống KIYOMARU. Do Dự án cấp nước an toàn quy mô nhỏ sử dụng chất keo tụ vô cơ thiên nhiên cho khu vực nông thôn của tổ chức JAICA – Nhật Bản sản xuất.	
Địa chỉ nơi sản xuất: Trường Trung học cơ sở Phan Huy Chú, huyện Thạch Hà, tỉnh Hà Tĩnh.	
Phù hợp quy chuẩn kỹ thuật QCVN 6-1:2010/BYT.	
Bản thông báo này chỉ ghi nhận sự cam kết của doanh nghiệp, không có giá trị chứng nhận cho sản phẩm phù hợp với quy chuẩn kỹ thuật tương ứng. Doanh nghiệp phải hoàn toàn chịu trách nhiệm về tính phù hợp của sản phẩm đã công bố.	
Định kỳ 03 năm tổ chức, cá nhân phải thực hiện lại việc đăng ký bản công bố hợp quy./.	
<b>Nơi nhận:</b> - Tổ chức, cá nhân; - Lưu: T. Tra.	<b>CHI CỤC TRƯỞNG</b>  Phan Văn Hùng

CỘNG HOÀ XÃ HỘI CHỦ NGHĨA VIỆT NAM  
Độc lập - Tự do - Hạnh phúc  
THE SOCIALIST REPUBLIC OF VIET NAM  
Independence - Freedom - Happiness  
\*\*\*\*\*

**GIẤY CHỨNG NHẬN**  
CƠ SỞ ĐỦ ĐIỀU KIỆN AN TOÀN THỰC PHẨM  
*Certificate of food safety conditions*

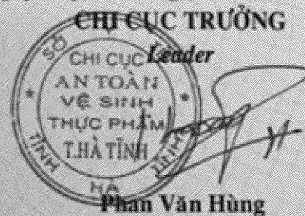
**CHI CỤC AN TOÀN VỆ SINH THỰC PHẨM TỈNH HÀ TĨNH**  
Food Administration of Ha Tinh province

**CHỨNG NHẬN**  
*Certifies*

**TÊN CƠ SỞ (Name of food establishment):** Trường trung học cơ sở Phan Huy Chú  
**CHỦ CƠ SỞ (Owner):** Trần Đức Luyện  
**ĐỊA CHỈ (Address):** huyện Thạch Hà - tỉnh Hà Tĩnh  
**ĐIỆN THOẠI(Tel):** 0914.111 156

**ĐỦ ĐIỀU KIỆN AN TOÀN THỰC PHẨM THEO QUY ĐỊNH**  
*Conforms to food safety regulations*  
**SẢN XUẤT NƯỚC UỐNG ĐÓNG CHAI**

Hà Tĩnh, ngày (day) 10 tháng (month) 02 năm (year) 2015



**Số cấp: 72/2015/ATTP-CNĐK**  
**(Reg.No)**

**Có hiệu lực (Valid until)**  
**đến ngày 10 tháng 02 năm 2018**  
**(Day) (Month) (Year)**

ATTACHMENT No.4: Outlines of Respective Site

Outline of Equipment Installations in Ha Tinh Province (1)

No	Location	Demand		Raw water	Current status of water usage		Facility proposed	Protection facilities		Note
		No of user	Water usage purpose		Drinking	Domestic purpose		by User	by 3S	
1	Phan Huy Chu Primary School - HOH Study			HOH Study: Underground water from dug well 3S study: public water system			Medium size equipment	Done: Base, Fence and Steel Roof		the experiment location in HOH Survey
2	Luu-Vinh-BacSon Secondary School	761 persons (610 Pupils; 51 teachers & Staffs)	Drinking	dug well, alum contaminated water	Teachers and staffs: boiled rain water Pupil: Buy/Prepare by themselves	From dug well	Medium size equipment		Base, Fence and Steel Roof	
3	Loc Ha District Hospital	1,000 persons (120 staffs; 140 in-patients, 150 in-patients' relative; ~600 checking patients)	Drinking and Domestic Purposes	Bored well, alum contaminated water which is treated simply by sand, coal ...	Staffs: boiled rain water Patient: Buy/Prepare by themselves	From bored well and simply treatment	Medium size equipment	Base, Fence and Steel Roof		
4	An Loc Primary School (and An Loc Kindergarten, Medical Central)	~ 750 Persons. In which: School: 450 persons (228 Pupils; 22 Teachers & staffs) Others: ~300 persons	Drinking and Domestic Purposes	Bored well, alum contaminated water which is treated simply by sand, coal ...	School: 20 liter bottled water (15,000 VND/bottle) x 14 bottles per day	From bored well and simply treatment	Medium size equipment		Base, Fence and Steel Roof	
5	Nguyen Hue High School	~1900 persons (1785 pupils; 104 Staffs)	Drinking	Water of bored well	Staffs: water treated by a compact filtration machine Pupil: Buy/Prepare by themselves	Water of bored well	Medium size equipment	Parking area of the school (arrange new fence)		
6	Song Lap Kindergarten	~200 persons (180 pupils; 20 Staffs)	Drinking	Water collected from the central well of the village	Boiled rain water	Water collected from the central well of the village, but the amount is not adequate. 5-6 times/year, the village has to pump water from Pump Station with DucTho District's water source	Small equipment	Located in the school kitchen		
7	Vuong Loc Primary School	~800 persons (Branch no1: 555 pupils; 44 Staffs/ Branch no2: 220 persons)	Drinking	Water of dug well	20 liter bottled water x 24 bottle per day	Water of dug well	Small equipment/s for each branch			
8	Phan Dinh Phung High School	~1800 persons (1702 pupils; 111 Staffs)	Drinking	Public water system	20 liter bottled water x 39 bottle per day	Public water system	Medium size equipment	Located in the central yard, (prepare fence, roof, base)		To be the typical location for introducing new technology
9	Bac Ha Kindergarten	~550 persons (497 pupils; 36 Staffs)	Drinking	Public water system	20 liter bottled water	Public water system	Small equipment			
10	Thach Trung Primary School	~600 persons (532 pupils; 45 Staffs)	Drinking	Public water system	20 liter bottled water	Public water system	Small equipment			

## Outline of Equipment Installations in Ha Tinh Province (2)

No	Location	Demand		Raw water	Current status of water usage		Facility proposed	Protection facilities		Note
		No of user	Water usage purpose		Drinking	Domestic purpose		by User	by 3S	
11	Public Security Department of Loc Ha District (and PC of Loc Ha District)	400 persons (~120 Public Security Department; ~300 PC)	Domestic water	Bored well, alum contaminated water with terrible smell	Boiled water treated and sold from Border Defence Department with the price of 15,000 VND/m3.	Water treated from Border Defence Department. The applied treatment method is simple with sand & coal.	Large size equipment	Fence, base and roof		
12	Thach Luu Residential area	550 persons (250 of kindergarten, 250 of primary school) and 50 surrounding residents	Domestic water	Bored well	Boiling of rainy water	Bored well's water which is treated simply by sand and rock	Medium size equipment	Fence, base and roof		
13	Bac Son Residential area	500 persons (250 of kindergarten and 250 of primary school)	Drinking water	Bored well with the depth of 50 - 60m	Boiling of bored well water	Bored well	Medium size equipment	Fence, base and roof		
14	Thach Mon Residential area	870 persons (200 of kindergarten and 220 of primary school, 50 of Commune PC; 200 of market, and 200 of surrounding resident)	Drinking water	Bored well with the depth of 17m	Buying public water from water station and boiling for drinking	Bored well	Medium size equipment	Fence, base and roof		
15	Viet Xuyen Residential area	200 households with total 900 persons	Domestic water	Bored well/ dug well with the depth of 9m	Boiling of rainy water	Bored well/ dug well	Medium size equipment	Fence, base and roof		<i>The area is warehouse of pesticide (DDT) during the war. The underground water is impacted terribly by pesticides distracted to ground.</i>

### Outline of Equipment Installations in Vinh Long Province (1)

No	Location	Demand		Raw water	Current status of water usage		Facility proposed	Protection facilities		Note
		No of user	Water usage purpose		Drinking	Domestic purpose		by User	by 3S	
1	Sao Mai Kindergarten	205 persons (186 Pupils; 19 teachers & Staffs)	Domestic purposes & Drinking	River water	20 liter bottled water (10,000 VND/bottle)	River water which is treated simply by alum and chloride	Small equipment			
2	Phu Loc Secondary School	197 persons (186 Pupils; 19 teachers & Staffs)	Domestic purposes & Drinking	River water	Teachers and staffs: 20 liter bottled water (10,000 VND/bottle) Pupil: Buy/Prepare by themselves	River water which is treated simply by alum	Small equipment			The treated raw water which has bad smell, is just used for sanitation
3	Loan My B Primary School	109 persons (89 Pupils; 20 teachers & Staffs)	Drinking	River water	20 liter bottled water (12,000 VND/bottle)	River water which is treated simply by alum	Small equipment			
4	Son Ca 2 Kindergarten	96 persons (80 Pupils; 16 teachers & Staffs)	Drinking	Puplic water supply	20 liter bottled water (10,000 VND/bottle)	Puplic water supply	Small equipment			
5	Trung Hieu Kindergarten	~400 persons (360 Pupils; 20 teachers & Staffs)	Domestic purposes (~100 m3/month) & Drinking	Puplic water supply/ River water which is supplement for shortage of public water	Teachers and staffs: 20 liter bottled water (12,000 VND/bottle) Pupil: Buy/Prepare by themselves	Puplic water supply	Medium size equipment	Base, fence and steel roof		Present public water supply is not adequate for domestic purposes
6	Trung Thanh Dong Medical centre	~60 persons (8 staffs; 50 checking patients)	Domestic purposes & Drinking	River water	20 liter bottled water (8,000 VND/bottle)	River water which is treated simply by alum and chloride	Small equipment			
7	Quoi An Medical Centre	~100 persons (10 staffs; 30 in-patients, 60 checking patients)	Domestic purposes & Drinking	River water	20 liter bottled water		Medium size equipment		Roof (underconsideration)	The experiment location in HOH Survey
8	Tan Quoi Trung Commune People Committee (with kindergarten, medical centre and surrounding households)	~2000 persons (200 - PC; 60 - kindergarten; 200 - medical centre and 400 households)	Domestic purposes & Drinking	River water	PC officials: Boiled river water after treatment Guest: 20 liter bottled water (13,000 VND/bottle)	River water which is treated simply by alum and chloride	Medium size equipment	Located in storage house (arranging a new fence)		The PC's office will be the centre of safe water for the commune
9	Ngai Tu C Primary School	~220 persons (200 Pupils; 16 teachers & Staffs)	Domestic purposes & Drinking	Puplic water supply	20 liter bottled water		Small equipment			The experiment location in HOH Survey
10	Nguyen Trung Truc Primary School	~175 persons (168 Pupils; 5 teachers & Staffs)	Domestic purposes & Drinking	River water	20 liter bottled water		Small equipment			The experiment location in HOH Survey

### Outline of Equipment Installations in Vinh Long Province (2)

No	Location	Address	Responsible person	Demand		Raw water	Current status of water usage		Facility proposed	Protection facilities		Note
				No of user	Water usage purpose		Drinking	Domestic purpose		by User	by 3S	
11	Quoi An Kindergarten	Quoi An Commune, Vung Liem District, Vinh Long province	Mrs. Nguyen Thi Hong Nhung, Rector, Tel. 0976.575.116	~120 persons (110 Pupils; 6 teachers & Staffs)	Domestic purposes & Drinking	River water (from small Canal in front of the school)	20 liter bottled water (10,000 VND/bottle)	River water which is treated simply by alum and chloride	Small size equipment	Base, fence and steel roof		<i>Water quality in the canal is not stable and polluted by waste. It is needed to find other water source: good river water or underground water</i>
12	Trung Thanh Dong Commune PC	Trung Thanh Dong Commune, Vung Liem District, Vinh Long Province	Mr. Chau Minh Tung, Deputy Chairman, Tel. 0902543589	400 persons within 200 m diameter	Drinking	River water, the source is not impacted by tide system because they can reserve water in a canal with controlling dam.	20 liter bottled water	River water which is treated simply by alum and chloride	Medium size equipment	Base, fence and steel roof		<i>The installation place is not fixed yet</i>
13	Tan An Hoi Medical Centre	Tan An Hoi Commune, Mang Thit District, Vinh Long Province	Mr. Pham Hoang Minh, Rector, Tel. 0987416449	109 persons (9 doctors and staffs; 100 patients/day) and surrounding households	Drinking	River water	20 liter bottled water (12,000 VND/bottle)	River water which is treated simply by alum and chloride	Medium size equipment	Pipe system and pump	Fence	<i>The access road is very small, equipment can be shipped to the bank of river; the user will ask support from Commune PC for moving equipment to installation place.</i>