WaQuAC-NET Newsletter
Water Quality Asian Cooperation Network

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For Safe Water, Do Network.

WaQuAC-Net Mini-talk NO. 4

Leakage control and safe water supply

On November 17th 2010, the 4th meeting was held in Yurakucho, Tokyo. The members are as follows. Mr. SHIMOMURA (Saitama City Waterworks Bureau). He has worked in Brazil for three years. Mr. WADA and Mr. IDE (Yokohama City Waterworks Bureau). They have worked in Vietnam. Mr. NAKANOSONO (President of Jeck associates). He has worked in Kenya, Saudi Arabia etc. Mr. KAWASHIMA and Mr. TAKAHASHI (Saitama City Waterworks Bureau) worked in Laos, Mr., SASAKI, the expert of water quality control about biology, has worked in Thailand and Cambodia. Mr. OKUBO (JICA Senior volunteers) who is now working in Bolivia. Ms. Nirmala Hailinawati, Graduate school of Tokyo Institute University, a thesis topic is on the non-revenue water in Indonesia. Mr. HORIE, Graduate school of Tokyo Metropolitan University, a thesis topic is on the energy saving of the water distribution in Tokyo. The organizer is Ms. Yamamoto. A total 11 members gathered together. The organizer, Ms YAMAMOTO asked following questions 1) Current situation of the water leakage in the country you have worked, 2) Is it possible to transfer technology of the leakage control? 3) The sample case of the leakage reduction and water quality improvement by the control of water distribution network. 4) Can Japanese case serve as a useful reference? 5) What should we start from in the leakage control?

【A case study of Brazil】

Mr. SHIMOMURA Masahiro

Mr. SHIMOMURA

■Project name;
EFICAZ Project,
in SABESP (Sao Paulo Province Basic Sanitation Company)

■ Project duration; From July 2007 to July 2010

■Project goal; The advancement of the management ability of the non-revenue water

✧ Water supplied population is 26.7million. Length of pipe is 63,900km. The coverage of water supply is 99%. It is large water supply system. And revenue water ratio is 58.7%. So the non-revenue water ratio is high. Because SABESP provides water supply to the people living in slums (about 1.5 million people) by free of charge. The details of non-revenue water are water leakage, meter tampering, water theft (this is most common in wealthy area.) and free of charge water. While you walk through the city, you will find many cases of the leakage water in the street. The rate of leakage is from 20 % to 40% in the pilot area by the investigation. Our activities for the technology transfer mainly consisted of the regularization and optimization of the analysis on the quantity of distribution water, the measurement and maintenance of water flow, water pressure control, construction management of the pipe laying, block distribution system and building a personnel training system.

✧ It is basically possible to introduce technology of the leakage control. However, it is not just only introducing Japanese method of the leakage control but transferring technology based on the characteristics of the partner country. Although SABESP's managerial staff have enough knowledge of the leakage control,

the technology doesn't take root in field worker. The leakage control was only discussed about cost-benefit performance, so they missed a point that they have to use limited water resources effectively as a environmental issues. I thought it was important that all persons concerned water supply such as SABESP top management and field workers, customers and companies' people change their awareness for leakage and non-revenue water. And then, we promoted the change of awareness for those issues as one of our main pillars of activities.

✧ There is no case that leakage control or water distribution network operation could improve water quality in this project. The proper water supply is key point to improve water quality. For example, wastewater may enter to the pipeline during the water supply restrictions. Even if the leakage control is conducted properly, the water supply restrictions have still risks of accidents. After realization of stable water supply, leakage can be controlled.

✧ It's very helpful to know Japanese past experience including unsuccessful case. So I gave some advice on measures which I got from Japanese experiences. For instance, when the leakage rate was 20%, 30% and 40%, we have had each countermeasure respectively .

✧ Now I think it is important to tell them why leakage control is necessary, what is the water supply system's purpose, role, responsibility etc.

Photo of the meeting

【A case study of Vietnam】

Mr. IDE Masuji (PHASE 1),
Mr. WADA Yoshiharu
(PHASE 2)

Mr. IDE

Yokohama Waterworks Bureau has sent experts and received technical trainees from Vietnam since they worked for JICA grassroots projects and during the technical cooperation project for improving the water supply management to COWASU (Thua Thien Hue Construction and Water Supply State-one Member Company Limited) and other organizations in middle region. Mr. WADA and Mr. IDE have been engaged in this technical cooperation for many years.

■Project name; The Project on Human Resources Development for Water sector in the middle region of Vietnam.

■ Project (1) duration; Mar. 2007 to Feb. 2010,
Project (2); June 2010 to June 2013

■Project (1) goal; The capacity of COWASU is improved for "declaration of safe drinking water". The declaration means COWASU declares to the inhabitant that COWASU's supply water is drinkable. The purpose of the project will be 1) The capacity of water quality management is improved. 2) The capacity of water distribution network management is improved. 3) The capacity of human resources development and personnel management are improved. 4) The capacity to response to the customer's need is improved.

Project (2) goal and purpose, please see
http://www.waquac.net/english/pdf/newsletter201009_en.pdf

Mr. WADA

Project (2) provides technical assistance for all over the central region of the Vietnam.
The current situation is as follows;

Name of Water Supply State-one Member Company Limited (WSC)	rate of leakage
Hue	13%
Da Nang	21%
Nghe An	35%
Dak Lak	24%
Khanh Hoa	20%
Quang Tri	22%

✧ It is problem that drawings installed pipeline network are not preserved neatly. There is insufficient water due to insufficient water pressure in the area far from treatment plants. There are some cases that PVC pipe restarted to leak a few years after the pipe is replaced. The quality of raw water has worsened with higher iron and manganese concentration in Hue, because hydraulic dam was built in upstream of the water intake point. Manganese remains in the treated water due to water treatment without pre-chlorine treatment. So tap water turned black and manganese stay attached to inside the pipe and the meter. Therefore, it is necessary to use POLLY-PIG for pipe cleaning every year. WSCs (Water Supply Company) other than Hue take measures as renewing and installing pipes for the leakage reduction.

✧ Human resource development is necessary to engage in technology transfer of the leakage control. It will be possible to do own leakage control and water distribution operation by human resource development. It is necessary to cultivate human resources of the water quality management section, especially because water quality monitoring cannot be done without water quality analysis. As a result of doing leakage control and distribution network management, they could improve water quality. That is why they have done POLLY-PIG for pipe cleaning and water quality monitoring at the same time. Da Nang WSC could reduce leakage water by pipe installation and introducing monitoring system like a SCADA, EPANET.

✧ It is very helpful to know Japanese past experience in water supply. Now all WSCs introduce distribution blocks system. There are a few complaints by water restriction in Vietnam. So, purpose of the distribution blocks system is not measures against water restriction as Japan but leakage reduction. All of the WSCs in Vietnam are interested in leakage reduction. So we introduce Water Distribution Control of the case of Yokohama Waterworks Bureau.

✧ At first, it requires that they gain an understanding of the actual situation neatly to deal with the leakage control. It is required to consider what they could start by knowing their actual situation and their model they can learn. It is difficult to keep up leakage control, unless they think by themselves and take action. Especially, to think by themselves is very important. For example, it seems that staff who participated in technical training of Yokohama Waterworks Bureau and can think by themselves make a huge difference from other staffs for the ability to manage or apply new system and equipment. It is also important to re-form executive staff consciousness for the leakage control. If inhabitants do not inform WSC about street's water leakage, it cannot be solved. So, inhabitants also need to be careful about water leakage. The installation of the flow meter and water meter is needed to measure the leakage water.

【A case study of Saudi Arabia】

Mr. NAKANOSONO Kenji

(JICA expert: From 1999 to 2000)

✧ In Saudi Arabia, water Source of the water supply is From desalinated seawater and deep ground water. Leakage control is very important because they do not have alternative water source. The rate of leakage was approximately 30 %. For example, the pipe

Mr. NAKANOSONO

deviation occurs due to high temperature of deep groundwater. It was insufficient to figure out actual situation of the water distribution, pipe network management and management of drawings etc. It takes much time to survey water leakage by water leak detection, because they cannot manage the drawings well.

✧ Nowadays, it is easier to survey water leakage by using new water leak detection equipment (Zone scan 820, German). It can collect the data and information of the water leakage by radio after installing logger on the tap, valve and fire hydrant in pipe network. We can use it widely and easily for leakage detection and find leak point. There are some exploratory case studies in Japan. So local governments and consultant firms make team and can work for leakage control.
(http://gutermann-uk.com/documents/Product2Zonescan820Mar10.pdf)

✧ It is important to gain an understanding of the actual situation to deal with the leakage control. There are several cases that persons who have a lot of knowledge through study abroad do not have ability of the field technique. So it is required to develop human resources and involve a key person. And it is also important to estimate amount of loss by leakage.

【A case study of Laos】

Mr. KAWASHIMA

Mr. KAWASHIMA Hiroyasu (JICA expert)

There are several cases of water quality deterioration in the distribution net by wastewater's entering into the pipes, because the water pressure become negative at peak time due to using buster pumps in every home in Laos.

My main activities were

1) Save water champagne to change people's thinking about water 2) Cooperation with water tariff revision. That is why large users waste a lot of water due to inexpensive water price. 3) Cooperation with changing the rule of budget allocation and strengthening government administrative control. When water supply corporations reduce non-revenue water rate, they are given priority for receiving the budget.

✧ The most important issues of leakage reduction are management of drawings of underground pipes, water pressure control by block system, and replacing parallel small diameter pipes with one proper large diameter.

【A case study of Bolivia】

Mr. OKUBO Akihiro (JICA senior volunteer)

I was surprised that one of the Bolivia public water supply utility does not have drawings of the distribution network. Managerial staffs have a lot of knowledge of the leakage control, the technology do not take a root in field workers. It is required to re-form staff consciousness and attitude in work place before transfer technology.

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【Opinion】

✧ **Ms. Nirmala**; illegal connection is still a big issue in Jakarta. Some irresponsible consumers are reluctant to pay tariff. It might quite hard to cut off all, since some of them have unendorsed power in local area. Local government decides water tariff and this tariff cannot cover all operational cost in many water companies in Indonesia.

✧ **Mr. SHIMOMURA**; IWA guideline is a bible for reduction of non-revenue water. There is a little difference between Japanese guideline and IWA's guideline. This will make it difficult to engage in technology transfers in developing countries.

✧ **Mr. TAKAHASHI**; I think it is necessary to make paper-based drawings of water distribution network at least.

✧ **Mr. SASAKI**; Leakage causes not only

leaking water out but also entering polluted water in. So, we need recognition that leakage water makes secondary pollution.

✧ **Mr. WADA**; Even if water supply companies declare that tap water is drinkable, inhabitants will not drink tap water. So it is necessary to educate people from childhood.

【Overview】

This meeting continued for 3 hours. Thank you so much for participating in this meeting. I noticed similar situations in each country. Each country could not figure out current situation of the leakage water. So, they could not set a clear target. I think it is important to grasp current situation of the leakage water and water distribution network as much as possible. Actually, it is difficult to grasp all due to shortage of workers, difference of the culture, and custom etc. That is why it is important to make a system for storing data and managing drawings at first. Secondary, it is necessary for staff to realize the importance of that kind of things. And it is most important that they manage themselves.

Mr. Wada said that to have a definite target utility leads reforming staff consciousness. So we need to release information of Japanese leading water supply technologies and experience as much as possible.

(by Mr. HORIE Toshiki)

All Participants

Introduction of the study on "suspended particles and their chemical composition in water distribution system" (summary)

Mr. Ma Noravin, a WaQuAC-NET member of Cambodia, has studied the distribution network system at the graduate school in Hokkaido University, supported by JICA from 2005 to 2007. He wrote a master thesis with title above. He is a deputy director of Production and Distribution Department, Phnom Penh Water Supply Authority (PPWSA) now.

Mr. Ma Noravin

1. Objective:

New EPOCH (Evaluation and diagnosis of Pipeline functions by Observing pipe Characteristics) project was carried out by Japan Water Research Center. The report in 2005, revealed that 77% of water suppliers received customer complaints about tap water quality and 81% of the customer complaints mentioned about turbid water (including red water). These are caused by

* Inner-surface corrosion of pipe 42%
* Fragmentation of plastic lining 13%
* Precipitation of Fe, Al, Mn 18%
* Introduction by construction works (pipe installation, repairing, etc.) 19%

This research was implemented as part of New EPOCH. To respond the customer complaints, chemical composition of suspended solids (SS) in water distribution system was analyzed.

2. Method: We investigated the pipe condition by using cable camera and measured SS concentration in water flowing through the distribution mains using the method that withdraw water samples directly from mains (through air valves, fire hydrants). Location of sampling sites and Characteristic of pipe are:

・Yokosuka-shi Uraga (4 sampling points),
・Kobe-shi, Dojou-cho (2 sampling points).
・Kobe-shi: Kanokudai, (3 sampling points).
Pipe materials are DIP, SP, CIP.

3. Conclusion:

1) Fe, Al, Mn, Ca, Mg are the major elements constituting the SS concentration in water distribution system.

2) Corrosion of pipe is the cause of SS concentration increase, especially Fe concentration.

3) SS concentration increase toward the dead end location of the mains.

4) Increase of SS concentration is caused by increase of flow velocity because of re-suspension of sediments on the bottom of the mains.

5) Decrease of residual chlorine concentration is caused by increase of SS concentration.

6) Decrease of residual chlorine concentration is more related to the materials of inner-surface pipe than detention time.

(Summarized by Ms. YAMAMOTO)

WaQuAC's Expert ・・・ Report of Activities ・・・

One of WaQuAC-Net's Activities is to exchange technical experience in Japan and overseas. This is the 3rd activities, ***Mr. Sasaki Shinichi,*** a biologist, visited the Phnom Penh Water Supply Authority (PPWSA) in Cambodia and Metropolitan Waterworks Authority (MWA) and Provincial Waterworks Authority (PWA) in Thailand from September 30 to October 8 as an expert of WaQuAC-NET. Mr. Sasaki were warmly welcomed by three organizations received lot of questions, exchanged ideas and made advises there. Here is the summary of "The activity report of the 3rd WaQuAC- NET overseas assignment

1. Schedule

Date	Activities
9/30 (Thr)	Tokyo - Phnom Penh
10/1 (Fri)	PPWSA; Courtesy call to Advisor of General Director and Director of Production & Distribution Technical exchange with staff of lab.
10/2 (Sat)	PPWSA; Instruction and observation in the field of biology
10/3 (Sun)	Site observation Phnom Penh - Bangkok
10/4 (Mon)	MWA; discussion in lab and site observation
10/5 (Tue)	MWA; Lecture in Samsen WTP PWA; Discussion with Director of Water Quality
10/6 (Wed)	MWA; Courtesy call to Governor
10/7 (Thr.)	MWA; Site observation to Samsen WTP Leaving Bangkok
10/8 (Fri)	Arriving at Tokyo

2. Contents of activities

1) PPWSA

(1) Courtesy call to Dr. Visoth (Advisor of General Director) Dr. Visoth expected Mr. Sasaki would instruct to lab staff well.

Mr. Sasaki, Mr. Vutiarith (Director), lab staff

(2) Discussion and instruction with staff of lab

✧ Confirming continuity of project on biological survey at water source, treatment plants and taps.

✧ Lecture on outline and countermeasures of creatures in pipeline such as Nematoda.

✧ Providing information on protozoan pathogen such as Cryptosporidium

✧ Lectures on influence and countermeasures against algae grown around trough of sedimentation basin and filter.

2) MWA

(1) Courtesy call to Governor Mr. Chareon Passara. We discussed follows.

✧ Younger staff members of MWA do not have experience of working with Japanese. This time is good occasion for MWA to get know each other and like to continue contacting by e-mail.

✧ MWA proposed that WaQuAC-NET could hold a seminar for PR of the NET to many people. CTC of NWTTI is available for the venue.

✧ The seminar can be open internationally and South East Asian countries may join there.

✧ MWA requested Mr. Sasaki make advises to younger chemists in lab and Samsen WTP

(2) Discussion and instruction to staff in Lab and site observation

✧ Accompany to survey to boat accident point in River Chao Phraya

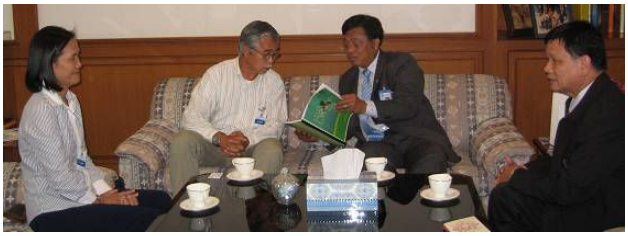
✧ Instruction on biological identification method to new employees.

(3) Discussion and instruction with staff in Samsen WTP

✧ Introduction of Japanese cases on relation between operators and staff of lab

✧ Measures against raising sludge in the pulsator. (It was caused by stuck of inclined tubes due to algae and turbidity. Regular washing by hose was recommended.)

✧ Observation of treatment facilities



With MWA Governor

3) PWA

(1) Courtesy call to Manager of Water Quality; Ms. Ratana. We discussed follows

✧ PWA has concerned issues of high hardness in southern Thai.

✧ PWA has problems of treatment and water volume in anywhere in Thailand.

✧ PWA conducts seminar for scientists and engineers every year. WaQuAC-NET is welcomed to participate there.

✧ PWA needs information on protozoan pathogen such as Cryptosporidium and pipeline creatures. (Mr. SASAKI Shinichi, Yokohama Waterworks Bureau)

Self introduction of New Member Ms. Tith Linda (Cambodia)

I have been working for Battambang Water Supply in Cambodia, which supplies water to the town people.

I was graduated from the chemical engineering faculty, Institute of Technology in Phnom Penh of Cambodia in 1992 and I have been working for Battambang Water Supply since 1993. Now I am Deputy Director and in charge of Water Production and Distribution Network Section. In the time being, I graduated two master degrees in Cambodia of Business Administration in 2006 and Public Administration in 2009. I had a good opportunity to go to Japan to join training course on Water Supply Management for Provincial Waterworks from May 17- Jun 14, 2006 and Water Quality Monitoring from Aug 6 – Sep 7, 2007 and also take a training course in Thailand on Management of Water Supply Business from Nov 9- 27, 2009. I have coordinated and responsible for a team in my waterworks which participate in the project of JICA. It has been carrying out on Capacity Building for Water Supply System in Cambodia Phase 2 for improving the provincial waterworks and the managing water section since May 2007 and expected to be completed in April 2011 for eight provincial Waterworks including my organization.

I got married in 1993, my husband is hydrological engineer and we are both working. Now I have two children, daughter is 16 years old

and she studies at 12th grade, my son is 14 years old and studies at 9th grade. In the weekend our family likes staying at home making delicious food and eating. In free time my husband likes playing sport, daughter likes reading books and son prefers to watch TV. For me I like knitting scarf and sweater because knitting will give me a pleasure time and relaxation and I can create handmade knits for myself and for my lovely family and when I give a lovingly knit gift, part of me go into it.

I improve water quality management and water treatment process by monitoring water quality in treatment process and from water sources to water taps for supplying safe water. Also I improve the maintenance of water treatment plant and distribution facilities. On the other hand, to supply water to the downtown area is limited because the water pipelines don't cover fully in the present water supply area and the old and deteriorative pipes remain which is the cause of the difficulty of water leakage control. Therefore, in order to improve water supply, I have to make Master Plan for expansion of water supply area, new installation of distribution main pipes and replacement old pipes for non-revenue water reduction. Due to manage the distribution flow, water pressures, and water leakage, water supply area has to divide into blocks.

My expectation from WaQuAC-NET is a place for exchanging opinion, discussing problems, learning experiences and developing the capacity for supplying safe water sustainably. This network system is very helpful to contact experts for helping to develop and improve my present waterworks situation through my daily tasks and my responsibility. The gained knowledge from this network will also shared to my colleagues and subordinates staff to develop their ability and we can supply safe water to the people in our country.

Hello Members !

Three women from MWA, Thailand appeared in Tokyo. They enjoyed Japanese cuisine and talked about their stay

Metropolitan Water works Authority (MWA), Thailand is a utility that women play a conspicuous role. *Ms. Chutima*、*Ms.Anchana* and *Ms. Naviya* working for the human resources department came to Japan privately in October, 2010. One of them has participated in the symposium held by NHK, Japan Broadcasting Corporation, and other two went sightseeing.
Mr. Sasaki and Ms. Yamamoto invited them to dinner in Shinjuku. I asked their impression of Japan
They said "High-Tech, especially high-tech toilet!" and burst out laughing. They continued talking that there are no graffiti in town and everywhere Japan seems very clean and safe. There are a lot of trees. People have hospitality‥‥They said only good things. They were really active and loved Japanese food. But I guessed they might miss Thai spicy taste a lot after one week stay in Japan. When they return to Bangkok, the third-countries training will start soon, they said.
(By Ms.YAMAMOTO)

Question & Answer Corner

We welcome any opinions, and questions to this Q&A corner!

We want to change the disinfectant from the chlorine (Cl2) gas into sodium hypochlorite (NaClO) by thinking about safety in our water treatment plant. And there are two options for getting NaClO, commercial NaClO and house generation system of electrolysis method. Please compare the two methods of NaClO. (Mr. M.N. Cambodia)

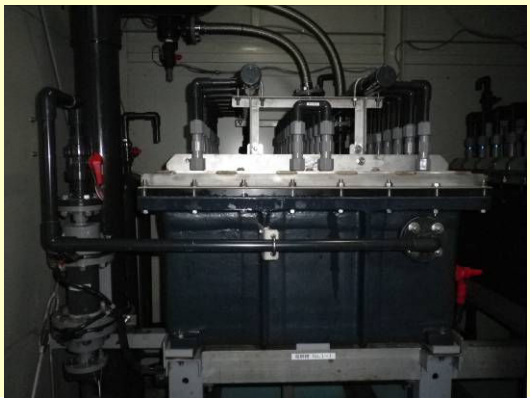
Q) Please compare the commercial NaClO with produced one by the house generation system of electrolysis method. And how many Watt of electric power are necessary for producing 1g NaClO ?

A-1) Example of Otaki WTP (Chiba prefecture)

Bulk water supply of the Otaki WTP was commenced for South Boso area in 1996. It is relatively new WTP which purify the raw water taken from Tone River and conveyed through Boso cannel – Nagara dam – South Boso cannel. It takes 3-4 days for treated water to reach to Shirahama area in Minami -Boso city which is farthest supply area. So that, we dose powder activated carbon in raw water and dose chemicals in the treatment process carefully. We have two additional chlorine dosing point in distribution mains for controlling tri-halo-methane. We have been using NaClO produced at the house generation system by electrolysis method as disinfectant since commencement of the Otaki WTP. NaClO production capacity is 300kg/d.

NaClO injector

The process of produced NaClO is firstly to dissolve salt in the water, to make saturation of salt, to send the solution to generator by pump. At the electrolysis tank in the generator, NaClO (1% concentration of available chlorine) is produced. Salt can be kept long time without changing quality. We buy salt seven times a year by dump track for the WTP and by 20kg/sack for additional chlorine dosing system. NaClO generation system is operated automatically using night time electricity charge which is cheaper than daytime. Two storage tanks of NaClO are installed outside, and concentration of NaClO doesn't degrease.



Eelectrolysis tank of NaCLO generator

We calculated the cost of house generation system in 2009 following

(a) NaClO production: 2,128,000 kg/y

Material: Salt 59,570kg about ¥2,600,000 /y

(b) Electric power: operation time 1,700 hours
Electricity consumption about 85,000kwh
Cost about ¥1,000,000 (basic charge not included)

(c) Maintenance cost (washing of electrodes by acid, re-coating of electrodes, and others)
¥5,000,000/y as average of 10 years

(a)+(b)+(c) = about ¥8,600,000 /y

Capacity of WTP is 55,060m^3/d. Actual transmission volume is 11,225,001m^3/y.

Day-average transmission volume is 30,753m^3/d.

Construction cost of generation system was about ¥ 140,000,000 (dosing facilities and storage tanks were not included)

Comparing the commercial NaClO, the merit and demerit of produced NaClO are follows.

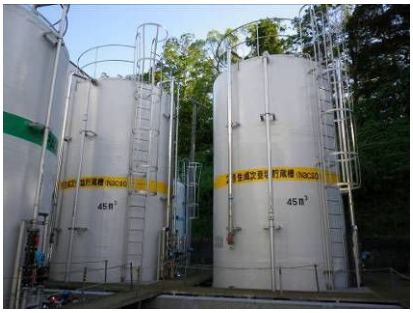
Advantage

- ○ It is possible to control delicate dosing because 1%concentration of available Cl_2
- ○ There are no gas generation in dosing pipe and a few separation of crystalline matter relatively
- ○ Storage tank can be installed outside (Commercial NaClO produce chlorine oxygen in high temperature and air conditioner is necessary)

Disadvantage

- ○ High initial cost
- ○ High maintenance cost

(Mr. IMAZEKI Hiroshi, Minami Boso wide area water supply authority)



NaClO storage tanks

＊(Reference)

Cost of commercial NaCl

Cost changes by area and distance from the factory when using the large tanker truck. K city waterworks department procures NaClO by 3t-large tanker truck and 200kg polyethylene containers. Unit costs of NaClO in 2009 were ¥ 39.27/kg by 3t- large tanker truck and ¥ 63.00/kg by 200kg polyethylene container respectively.

Commercial NaClO has 12% concentration of available Cl_2 and produced NaClO has 1% concentration, so that Volume of commercial NaClO would be one twelfth of produced NaClO in volume. Commercial NaClO needs gas out equipment. (Mr. ODASHIMA, Ms. YAMAMOTO)

A-2) Example of S City in Japan

A certain WTP in S city has produced 1,899,580kg of NaClO by electrolysis method in 2009 and consumed 89,390kwh of electric power.

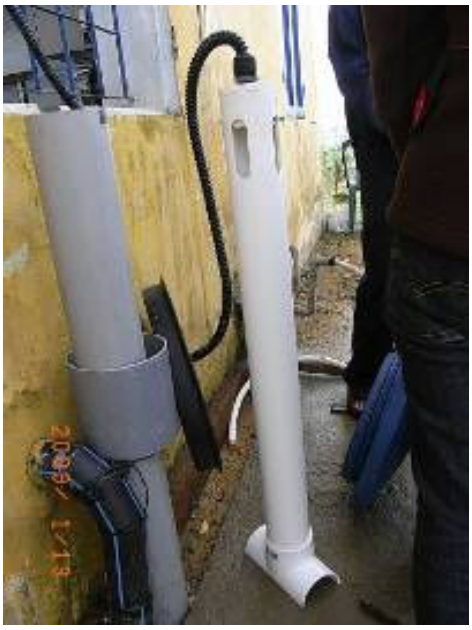
By the way, this system cost was ¥200,000,000 around. (Mr. ODASHIMA)

A-3) Example of Hue province water supply company, Vietnam

We use house generation system for producing NaClO in Quang Te II WTP and supply it to the Quang Te I WTP too. Production capacity of the Quang Te I and II WTPs are100,000 m^3/d in total. Produced NaClO volume is 35 – 40m^3 /d(concentration is 5.0g/L as NaClO and 0.48%as available Cl_2). Dosing rate of Cl_2 is 1.6mg/L. 7.58wh electric power is consumed for producing 1g NaClO. Production rate is 1.24m^3/hour or 6.2kg/hour. We use it in the small scale WTP in remote area. Capacity of generation is 300～400 m^3/d. NaClO production volume is 5g/L as NaClO concentration and 1.6mg/L as available Cl_2.

We also use house generation system in Yavia WTP.

(Ms.Tran Thi Minh Tam and Mr. SASAYAMA)



Electrode for small scale NaClO generator

Ms. Tam

Mr. SASAYAMA

Introduction of New Members
(as of December 2010)

○ Mr. Shunsaku Matsuo (Japan)

We welcome new member any time.
Please contact our office.

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will be issued in June,2011