

Happy New Year 2016

Sustaining Safe Water and Reliable Cooperation!

WaQuAC-NET Newsletter vol.27

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● Technical Q&A



Question & Answer Corner

We welcome any opinions, and questions to this Q & A Corner. Please contact us.

Q.: Head loss of our rapid sand filters has increased in a short time and the filters have clogged soon. We have often lost filter media from the filters. Let me know the issues to be considered when we select filter media and its maintenance.

(Mr. Z.O. Myanmar)

A1: Answerer

Mr. Katsuhiko TERASHIMA

Tokyo Engineering

Consultants Co.,LTD.

(Former official of Osaka City Waterworks Bureau)



Rapid sand filter has been used widely in most of waterworks all over the world, because it can produce a lot of amount of filtered water in small size of facility comparatively. It enhances the removal effect of turbid matters, chlorine tolerant

protozoa and so on by combining with coagulation and sedimentation process.

Filter Clogging

Filters clog with various reasons.

1) One of the reasons is that the inflow water to the filter may contain turbid matters more than the original design. In this case, improvement of coagulation-sedimentation process which is the previous treatment process of the filter, is necessary.

2) When turbid matters which was trapped in the filter media, cannot be removed by backwashing of the filter due to the wrong wash condition, filter clogging may happen. In this case, it is required to set the appropriate condition of the filter wash newly.

3) In the case that the filter clogging is caused by the filter media, it is thought that particle size of media is smaller than designed one.

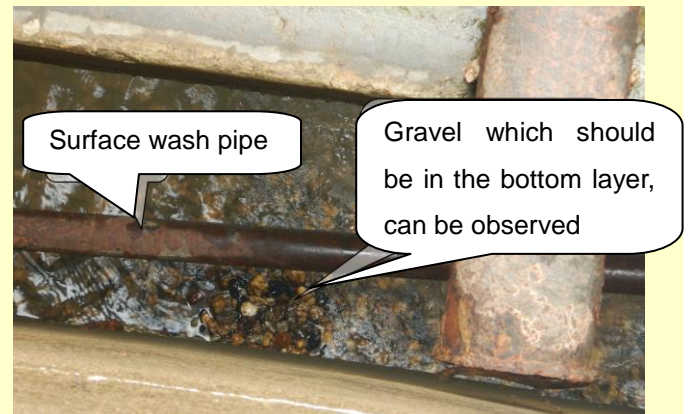
The particle size of filter media is generally shown by two parameters; one is an effective size (d_{10})* and the other is a uniformity coefficient (d_{60}/d_{10})*. When new filter media is used, it is essential to check the size of filter media by sieving test to confirm that the size is same as designed one. Even if the result of sieving test satisfies designed size, in the case that filter media contains very fine particles, e.g. less than 0.3 mm, it is said that filter clogs in a short time. The fine particles can be easily removed, because most of fine particles tend to gather on the surface after washing the filter.¹⁾

Dual media filter and multimedia filter are often used to get more large quantity of filtered water in the same filter size. As a dual layer filter, it is common to use anthracite in the top layer and sand in the second layer, because specific gravity of anthracite is lighter than sand although the particle size of anthracite is bigger than sand.

Therefore, the filter clogging happens less than single sand filter. And filtration rate can be set at higher speed compared to single sand filter, and

running time also becomes longer.

On the other hand, anthracite tends to flow out from the filter basin during filter washing. In the case that most of anthracite flow out and sand layer comes to top, it causes a filter clogging in a short time. It needs to pay a special attention for the media in the top layer so as not to flow out from the dual or multimedia filter. Regular check of the filter is very important. It is no matter whether the type of the filter is single or dual media. By the regular check system, a depth of each layer and particle size should be measured. When the media flow out more than the volume which is predetermined, media should be filled in the filter basin immediately.



Picture shows a filter. Two filter media, anthracite and sand have almost flowed out and gravel under the sand layer can be observed. Even though there are almost no filter media, operation of the filter has been continued. The reason that the filter media flowed out is thought not only single reason, but some reasons mentioned above have been combined in this case. It's also thought that there are no periodical check and maintenance system in the waterworks.

Using larger particle size of filter media would enable to make filter running time longer, so that larger amount of filtrate can be obtained. However, as imagined easily, using larger size media may reduce effectiveness of turbid mater's capturing and it is possible to compensate by increasing a filter media depth (L). This relation is explained as the ratio of depth of filter media to particle size of

media (L/d). So far, several coefficients, which are thought to be enough for filter function, have been proposed. There are some different coefficients (L/d), because different parameters of particle size (d) have been adopted in the proposed equations. Detail information may be obtained from the references of 1)-6). It is said that as the filter media depth, at least 1000 times of the effective size of filter media would be necessary. (e.g. an effective diameter is 0.6 mm, more than 60 cm of filter media depth is necessary.)

Flow Out of Filter Media

When filter washing condition is not adequate and washing rate is too high, it causes the loss of filter media. Even if filter washing condition is adequately set as the designed condition, in the case that the media size is smaller than the designed size, it also causes the loss of media.

In this case, confirming a size of filter media by sieving test is important.

“Japan Water Works Association Standard” (JWWA A 103: 2006-2 Filter media for water works) provides the standards of the physical properties of filter media, such as effective size, uniformity coefficient, etc. and their testing methods.

Filter media (particle size, specific gravity) and wash condition, especially backwash condition, have subtle relationship extremely, and keeping the relationship in good is to keep adequate function of a filter. It is desirable for staff in charge of water treatment operation to understand these key issues.

* d_{10} : effective size: the filter media particle diameter of passage weight percentage 10% in the sieving test. It is used widely as representative size of the media.

* d_{60}/d_{10} : uniformity coefficient: an index showing the degree of uniformity of a particle size distribution.

(d_{60} : the filter media particle diameter of passage

weight percentage 60% in the sieving test).

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- 3) Integrated Design and Operation of Water Treatment Facilities, Wiley, (1991)
- 4) K. Fujita, Journal of JWWA, No.485, pp.2-14,
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- 5) Filtration + Separation. Com;
<http://www.filtsep.com/view/29675/granular-filter-media-evaluating-filter-bed-depth-to-grain-size-ratio/>
- 6) Filter Operations and Performance, Marvin Gnagy, Ohio Section AWWA SDWA Seminar, November 4, 2013, p.19;
<http://www.oawwa.org/SDWA%20Presentations/2013/Filter%20Operations%20and%20Performance%20SDWA.pdf>

A2: Answer

Mr. Katsutoshi KAGATA
Former official of Kitakyushu
City Waterworks Bureau



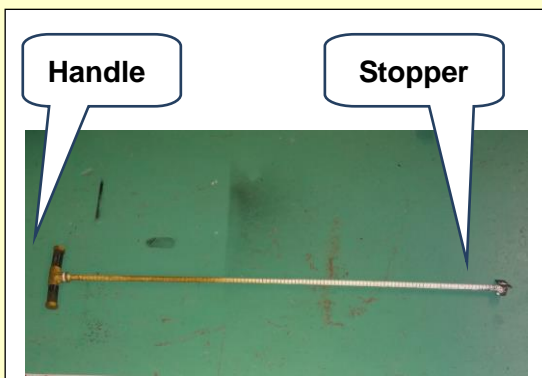
I would like to mention about the concrete maintenance of rapid sand filter from my experience.

Ability of filter is determined by sand layer depth and sand diameter (effective size). In order to get sufficient ability, the depth of layer needs more than 1,000 times of effective size. Commonly the sand whose effective size is 1.0mm and whose uniformity coefficient is 1.4 -1.6 is used as a filter media in Southeast Asia. When the diameter of sand is 1.0mm, required minimum depth is 1,000mm.

During backwashing, a very little sand flow out from filter basin, so the depth of sand layer

usually decreases a little bit gradually. But the decreasing rate is very small under appropriate backwashing. The depth of sand layer should be measured periodically at least once a year and when the depth is less than minimum standard (effective size multiply 1,000), sand should be refilled. Commonly, sand is refilled with around 15% excess of minimum standard. The specification report from the sand supplier should be checked before refilling.

1.5m iron bar with scale marked is used for measuring the depth of sand layer. Stopper plate and handle are welded. This tool is easily prepared at water treatment plant.



When the decrease is pretty large, check the **backwash water rate**. Too much backwash water makes much sand flow out, so it should be adjusted to appropriate rate according to designed specification. When air source is used together with backwash water, possibility of sand flow out becomes higher. When sand flow out is still much even after adjusting backwash water rate, separating air from backwash is one of the options to stop sand flowing out. For reference, the backwash water rate is 0.6-0.9m³/min/m² in Japanese standard.

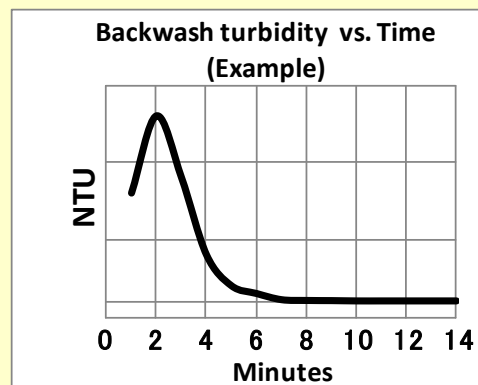
Another important parameter of backwash is **washing time**. Too long backwash time wastes clean water for backwash. Appropriate backwash time can be known by checking the graph of the backwash water turbidity versus the backwash time. Sample the backwash water at 1 minute Interval.



Sampling of backwash water at 1minute interval

Measure the turbidity and make the graph of the backwash turbidity versus the time.

For example, in the next graph, appropriate backwash time is around 8 minutes.



One more important maintenance work of filter is the checking of **floc retention** on the sand grain after backwashing. Most of adhered floc is washed away by backwashing but small amount of floc is retained. Floc retention is one of indicator to know the condition of sand layer (effectiveness of backwash). Sample should be taken from some points of depth of sand layer after backwash and draining. Digging sand layer and taking sample from each depth point is one sampling method. Using coring pipe is other easier method to take such samples. Electrical conduit of around 40mm in diameter and having scale marked is good for coring. Measuring method of **floc retention** (turbidity of wash water) in JWWA is as follows.

- Dry sampled sand naturally.
- Weigh 30mg of dried sand and put it into 500ml reagent bottle.
- Add 300ml of clean water and plug it.

- Shake it 150 times for 1 minute with 15cm stroke.
- Leave 3 minutes.
- Put 150ml of upper part into another bottle.
- Measure the turbidity of this wash water.
- Less than 30mg/l (Japanese turbidity unit) is standard, this number is around 50 in NTU

When solid retention is more than 50NTU, increase the frequency of backwash. When solid retention is very large such as more than 100NTU, reevaluate backwash procedure. The parameters which should be reevaluated are 1) backwash water rate, 2) time and 3) the mixing of air and backwash water. After reevaluating, periodical measurement of floc retention is desirable.

Frequent refilling and a lot of backwashing during many years' filter operation may change the effective size and the uniformity coefficient of sand. So the analysis of sand is recommended in every 5~10 years. When the result is very different from the original (designed specification),

rehabilitation should be considered. If you do not have the equipment for sand analysis, outsourcing to a sand supplier or a laboratory is one of the options.

Finally I would like to mention my idea about clogging of filter to questioner. He said filter media flowing out so often. It means that small grain of filter media has been lost a lot already. Therefore I think cause of filter clogging (head loss increased in short time) comes not from filter media, it comes from insufficient coagulation and flocculation. A lot of unsettled floc flows into the filter basin and makes clogging. Therefore appropriate dosing rate of coagulant (alum) is very important and this can be confirmed by jar test and observation of flocculation in actual process. One more cause of filter clogging is propagation of some kind of algae (e.g. *synedra acus*) in raw water. It is very difficult to coagulate and settle *synedra acus*. When this happened, frequent backwash is required.

2. Members' Activities

JWWA Conference, Ms. Sivilai gave a presentation

October 21 to 23, 2015, JWWA Conference was held at Saitama Super Arina.

Ms. Sivilai of MWA of Thailand came to Japan for giving a presentation in English session



Ms. Sivilai.K

of JWWA Conference. She arrived at Haneda on October 19 and prepared the presentation material with Mr. Sasaki. She joined a welcome party by her old friends in the following day. During the Conference, she observed Water Supply Exhibition and participated in the International Forum on Water Supply on 21-22. In the International Forum, 9 countries, Laos,

Australia, Thailand, Indonesia, Taiwan, Malaysia, US, India, Japan and representative of IWA (International Water Association), participated and they gave presentations on strengthening the relationship among the water supply associations. In the Japanese history of waterworks development, JWWA contributed a lot. I think this forum is very important.

In the morning of 23, English session was held and Ms. Sivilai gave a presentation on the result of biological survey in the central area of Thailand (See p.8, [Newsletter vol.23](#)) which was carried out by the cooperation between MWA and WaQuAC-NET. After her presentation, Moderator, Prof.. Okabe, Hokkaido University, asked two questions to her as follows.

Question 1 : What is a reason of algae bloom after

the flooding in October, 2011?

Answer 1 : The canal of law water was contaminated by nitrogen, phosphates and so on by the flood crisis in 2011. After that, precipitation decreased in Thailand and concentration of pollutants increased. Therefore, Algae bloom happened.

Question2: When filter clogging occurred in the WTP, did not odor problem occur at taps?

Answer2: It happened but a few.

In the same English session, Mr. Ozaki, Sakai Water Works and Sewerage Bureau, gave a presentation on Katmandu, Nepal water supply, too. He joined a mission of MHLW (Ministry of Health, Labor and Welfare of Japan) to Nepal. They surveyed the situation of water supply system after the big earthquake happening in Katmandu area. Mr. Kobayashi who works for Chiba Prefectural Waterworks Bureau, presented a situation of water leakage in East Timor (See p.3, [Newsletter vol.21](#)).

Presentation from foreign countries was only one from Thailand by Ms. Sivilai. I think that more participants from foreign countries should join to utilize this occasion for exchanging technical information and improving water supply each other. (by Ms. Yamamoto)



Ms. Sivilai's presentation



Welcome party for Ms. Sivilai

Ms. Siti Zainab Lubis
6 months Training at Yokohama



Ms. Zainab works in the water quality laboratory of Tirtanadi Waterworks Company, Medan, Indonesia (see p.2, [Newsletter Vol.23](#)). She came to Japan to take "the Kanagawa Overseas Technical Training Course" in late August, 2015. Last year, Ms. Oil from MWA of Thailand, took the same course in the same place (see p.3, [newsletter No.24](#)). In her first month, Ms. Zainab studied Japanese language. And then she is studying the water quality analysis at the water quality center of Kanagawa prefectural government. In this training program, 7 trainees were invited from different countries, China (2 persons), Vietnam (2), Malaysia, Benin and Comoro and Indonesia. They are studying different subjects respectively.

Ms. Zainab is a very active woman. She attended the conference of Japan Water Works Association held in Saitama city from Yokohama by a train for 3 days. I felt that she would get used to daily life in Japan soon.

WaQuAC-net held a welcome party for her in Yokohama on October 17. She came there with Ms. Okamura who is a coordinator for Ms. Zainab. 7 persons joined. Ms. Zainab talked to us cheerfully. She said she used to work at a TV broadcast company before. So, I understood why her talking was so nice. We enjoyed lunch and talking together for two hours. I expect to have another chance to talk with her.

(by Ms. Yamamoto)



Mr. Long Naro was invited to INCHEM 2015 as a lecturer

Mr. Long Naro, a deputy director general, Phnom Penh Water Supply Authority (PPWSA) Cambodia, invited to Japan by United Nations Industry Development Organization (UNIDO) from 22 to 28 November. The purpose of his visit was to make presentation and discussing with Japanese private companies on water business at the biggest exhibition on chemical and environmental engineering at Tokyo, "INCHEM TOKYO 2015".



Mr. Long Naro graduated from a university in Germany and then was employed to PPWSA in 1990. After that, he has worked as the counterpart of JICA, AFD, WB and ADB to contribute the development of PPWSA.

He visited Kawai water purification plant of Yokohama Waterworks Bureau on 24 November. There, he got information on ceramic membrane water treatment system and BTO (Built Transfer-Operate) business.

On November 26, he made the presentation on the successful case of PPWSA in front of 300 audiences at the Water Seminar. After that, he received several questions from audiences. He answered them as follows; "evaluation factors at the tender are quality, efficiency and cost" and "he expects an energy saving system from Japanese project". Many Japanese companies were interested in water business in Cambodia. Mr. Long Naro discussed with a lot of business persons for 3 days. (by Ms. Yamamoto)



Mr. Long Naro (left) is answering

Party with Mr. Sugawara and his counterparts from Indonesia

Dr. Shigeru Sugawara, a JICA expert in Indonesia, came back to attend IWA Seminar (LESAM 2015 at Yokohama) with his counterparts, Ms. Lucki and Ms. Latria w work in Human Settlement Bureau, Ministry of Public Work, Indonesia. His friends of WaQuAC-NET and Yokohama Waterworks Bureau held a welcome party for them at an Indonesian restaurant in Yokohama on November 16. We talked a lot with delicious Indonesian foods. We hope that Dr. Sugawara will have more good activities until his term will be finished. (by Mr. Sasayama, JWVA)



From left, Dr. Sugawara, Ms. Latria, Ms. Lucki,

3. Members Opinion

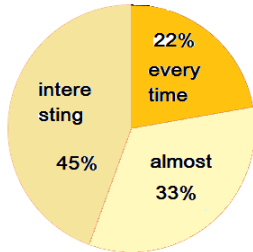
Result of Questionnaire on newsletter to Cambodian members

The number of WaQuAC-NET of non-Japanese members is 50. Among them 14 members live in Cambodia and 9 members of 14 work in Phnom Penh Water Supply Authority (PPWSA). As I had a chance to visit to PPWSA last October, I distributed questionnaire on WaQuAC-NET newsletter to them. And all members of PPWSA answered the questionnaires. The result is shown

as follows. I would like to say my thanks to answerers.

Q1. Frequency of reading the newsletter

Two persons read it every time. Three persons read almost every time. Four persons read it when there is interesting article. It means that 45% members cannot find interesting article sometimes. We have to think of more interesting articles



Q2. Interesting fields (plural answers O.K.)

Nine persons select “Water quality”, eight persons select “Water treatment”, and “Distribution net”, six persons select “Information of developing countries”. All answerers select water quality. Four persons who belong to laboratory, are also interested in pipe leakage. Four persons select Information of developing countries. Comparing to Japanese members, most of interested articles of them were information of developing countries. In PPWSA, their most interested issues are technical matters in PPWSA, while executives concern wider fields.

Q3. Interesting articles (plural answers O.K.)

Following is an order of interest.

1. Special reports
2. East Japan earthquake restoration
3. Q&A
4. Report of activities in foreign countries

Q4. Interesting Q&A (plural answers O.K.)

Recently, PPWSA changed coagulant from aluminum sulfate to Pori-Aluminum Chloride (PAC). Therefore, they are interested in PAC. And, they selected water quality criteria because PPWSA think to establish it. They also concern tap water quality.

Q5. Opinions or Requests

- To send a paper newsletter because internet environment is no good.

- To help how to get the certificate of ISO17025
- To try to circulate WaQuAC-NET Newsletter among middle class executives.
- To share the question among different countries and answer.
- How to check odor of water.
- Interested in wastewater treatment and the maintenance in water treatment plant.

Comment

WaQuAC-NET activity has started for exchanging information and technical knowledge of water supply through internet in 2008. So far, we could contact with members by internet. However, we have had not more chances to discuss with foreign members directly. This time I could meet 9 Cambodian members and heard their thought about WaQuAC-NET. I have to reflect their opinion in the activities this year. PPWSA is very famous for supplying safe water to people, in the world. And also, their facility and service are expanding quickly. Staffs of PPWSA should know a lot of knowledge and have skills. For keeping this condition, I hope to have more active relationship between PPWSA members and WaQuAC-NET. (by Ms. Yamamoto)



From left, Ms. H. Soursdey, Yamamoto, Mr. Keo Heng, Mr. P. Kunnarith

Introduction of New Members

○ Dr. Kenji Kimura (Japan)

◎ We welcome new members anytime◎
Please contact us

4. Activities in Japan

The 2nd Osaka Meeting International Cooperation of Water Utilities

**“Present situation,
Issues and Prospect”**

*Reported by Mr. Manabu Sugino
(Osaka Water Supply Authority)*



The 2nd Osaka meeting was held in the evening of September 11. Mr. Shigeyuki Matsumoto from JICA gave a special lecture on the international cooperation by water utilities. The participants were Mr. Miyauchi, Mr. Nagashio, Mr. Koseki, Mr. Fujitani, Mr. Ozaki, Mr. Hayashi and Sugino from the Kansai region, Mr. Saeki from Shikoku, Mr. Kagata and Mr. Oda from Kyusyu, Mr. Matsumoto, Mr. Sasayama and Ms. Yamamoto from Tokyo. The total number of participants was 33 including 20 non-members.

1. Opening Speech

by Ms. Yamamoto

Osaka branch has intensified their activities. She wanted to keep Osaka meeting longer.

● Special lecture

by Mr. Shigeyuki Matsumoto

1) Present situation

Strong points and hopes of water utilities in terms of JICA

Recently, private consultants have worked in many JICA technical assistance projects. They have advantage in investigations and designs, and know overseas countries well. On the other hand, Japanese water utilities are quite familiar with daily operation and maintenance of facilities and the emergency response like disasters. JICA concerns capacity development of utilities in

developing countries. In particular core capacity (leadership, management, awareness and so on”) is difficult to train. In order to change their mind-set, Japanese water utilities can train them from basic matters like “mission of water supply” repeatedly.

Dramatic changes in the past few years

Since 2000’s, one Japanese water utility has supported one utility in developing country. Water business has been booming since 2008. JICA’s cooperation schemes were diversified such as Yen loan, overseas loan and investment, and supporting SMEs’ overseas business expansion as well as conventional technical cooperation, grant aid, volunteer and grassroots projects.

The affiliated companies of Japanese public water utilities and the platforms for promoting water business by connecting private companies and local governments were established in many cities in Japan.

Cooperation by foreign water utilities

Some developing countries, like Thailand and Cambodia accept trainings and visits from other countries. They turn the supported countries into the supporting countries.



Mr. Matsumoto, giving a lecture

2) Issues

Difficult to secure experts to be sent in water utilities

Most of Japanese water utilities have reduced the number of staff. Though JICA’s technical assistance fields have been expanded from operation & maintenance to administration and

management fields, Japanese water utilities have fewer administrators than engineer, therefore, difficulties to dispatch the required personnel as experts.

Mismatch of JICA's supporting region

Though JICA's cooperation region has moved from Southeast Asia to South Asia and Africa, many utilities want to cooperate for Southeast Asia.

The necessity of compliance and fairness

The relationship between water utilities and JICA has been diversified, and JICA must take care for the compliance and the fairness of competition.

Duplication of areas where Japan water utilities cooperate

There are some cases that several Japanese water utilities support same water utilities in developing countries. The realignment and the adjustment of cooperation area is necessary.

Two faces of international cooperation and water business

Japanese water utilities must care to start water business, because it might affect the reliability of the relationship built through international cooperation

3) Prospect

Expansion of new cooperation area

The economic condition and cooperation issues of developing countries have changed. In other words, the possibility to cooperate has expanded. For example, as training subjects, simple water-supply system, and small scale water utility, wide area supply system are required. Then, water utilities, which have similar issues may become new recipient utilities of overseas trainees.

Next stage from ODA projects

Financially, ODA is limited. Some Japanese water utilities build partnership directly based on the trust relationships and connections through JICA's projects. Some Japanese water utilities expanded the cooperation area from water supply to other

areas. Some water utilities develop from international cooperation to water business. Some exploit not only JICA but also other resources.

Deeping relationship between the water utilities and the private companies

Japanese water utilities are public entity, limited to operate international cooperation actively. To do so, hooking up with private companies, bringing up private operators by training, or collaborating with the private companies are necessary.

Establishment of a confederation of water utilities for oversea expansion

The Netherlands establishes specialized utilities for overseas expansion, and it works actively. We also should consider founding an association of Japanese water utilities to offer total solutions instead of working by each.

● Panel Discussion

chaired by Mr. Hayashi. Panelists were selected from former JICA experts and living in Kansai except Mr. Matsumoto, Mr. Kiyoshi Miyauchi (Dispatched countries: Kenya, Egypt, Vietnam), Mr. Mitsuhiro Fujitani (Thailand), Mr. Daiji Nagashio (Myanmar), and Mr. Matsumoto, lecturer. Commentators were Ms. Keiko Yamamoto and Mr. Hiroshi Sasayama (Thailand, Cambodia, and Vietnam).



Moderator, Mr. Hayashi and Panelists

The panelists told about international cooperation of each water utilities and their experiences. Some points presented by Mr. Matsumoto were

confirmed with their experiences. In addition, the followings ideas are raised in the discussions;

- 1) importance of bringing younger generation for international cooperation,
- 2) utilization of JWVA's expert registration system,
- 3) importance of networking like WaQuAC-NET.

4. Comment

- I thought that we cannot be involved in international cooperation without any actions.

The circumstance of international cooperation has changed. Some water utilities conduct international cooperation and international business positively, although some utilities are not active recently compared with the past.

- There are many options to participate in international cooperation. JICA's cooperation schemes have diversified and there are many ways for us to work in international cooperation as a main player, an adviser and a reinforcing member.

- There is good example of Fukuoka City. A retired person worked in a developing country as senior volunteer and young people followed him. His experiences are conveyed to the next generation.

- Expecting to the second meeting near future As Mr. Matsumoto told us, we value the network of WaQuAC-NET, and more and more liven up the Kansai branch.

discussed. Why did we discuss about this topic? Recently, ODA (Official Development Assistance) is focusing to African countries in water supply field because development is still limited and low coverage of water supply. And more and more projects are expected to be implemented there. However, someone concerns there may be big differences between Asia and Africa. Since South-East Asia have had many grant aid and technical cooperation projects of Japanese government and water supply system and their management have been developed quickly. On the other hand, there are many problems in Africa. Can we cooperate to African countries by the same way as Asian countries? It's our question. At first, we discussed the experience of project in Africa. But, we need more information of water supply in African countries for discussion. It may be necessary to clarify several elements which have influence to successful and effective cooperation to Africa; such as their culture, custom, human resources, education, nature, weather, economy, politics and so on. Since this topic is very huge, we could not find conclusion. From now on we would like to continue discussing this topic as series.

(by Mr. Horie)

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WaQuAC-NET Mini-Talk
“Water supply in Africa and Asia”

WaQuAC-NET Mini-Talk was held on Sep. 25, 2015. The topic was “ Water supply in Africa and Asia”. Participants were Mr. Sasaki, Mr. Arimura, Ms. Yariuchi, Mr. Sakamoto, Ms. Kawamura, Ms. Yamamoto, Mr. Horie. Difference of water supply development between Asia and Africa was

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Next Activity

Feb.29, 2016 General meeting
 Mar. 8, 2016 Newsletter vol.28 (JPN)
 Mar.11, 2016 Farewell Party for Ms. SITI
 Apr.12, 2016 Newsletter vol.28(Eng.)