Q&A

11Q1: Are there “arsenic pollution problem” in the water supply using surface water?

A1： Arsenic pollution of groundwater comes from the geological condition. However, in the case of surface water, arsenic pollution is mostly caused by the wastewater of hot springs or mines. Arsenic in the water is removed by the pre-chlorination and sedimentation process.

Even though the concentration of arsenic in the water is very low, taking such water for long time causes the chronic poisoning such as keratosis of the skin, black skin, neurological disease and skin cancer. In the case that the source of water supply contains arsenic, we have to consider changing the source first. If it is difficult, we must remove arsenic in the water by some treatment methods such as, coagulation and sedimentation, adsorption by the activated alumina, nano-filtration and reverse osmosis. There is also the method of dilution. Arsenic exists in the water mostly as trivalent or pentavalent inorganic compound. Removing the trivalent arsenic is difficult in comparison with pentavalent. Therefore, trivalent is changed to pentavalent by pre-chlorination. The pentavalent arsenic is effectively removed by sedimentation process. It is also necessary to consider sludge treatment because the arsenic removed from water exists in sludge, (quoted from the Japan Design Criteria for Waterworks Facilities in 2000.)

Sapporo Water Works Bureau uses the river water which contain arsenic caused by the hot spring. Arsenic has been removed to under the water quality standard value (0.01 mg / L) by the coagulation sedimentation method. （A1, Answerer: YAMAMOTO Keiko, JICA, 2009）

A2: The answer of A1 above is quoted from "Japan Design Criteria for Waterworks Facilities 2000" (issued by the Japan Water Works Association) and is basically correct, but I would like to explain the coagulation sedimentation method in the purification process in more detail. Pentavalent arsenic can be removed by coagulation and sedimentation process. However, trivalent arsenic cannot be removed. Therefore, as mentioned above, all arsenic contained in raw water must be converted into trivalent arsenic by chlorination before coagulation and sedimentation process.

One of the large scale water works in Japan has an actual example of water treatment plant. There is a hot spring near the water source, so the arsenic concentration of the raw water is 0.03 mg / L. This value is three times higher than the water quality standards for drinking water in Japan. I asked the staff of waterworks bureau there about arsenic removal. "Although the proportion of trivalent arsenic at the spout of the hot spring water that causes arsenic contamination is high, and trivalent arsenic gradually becomes pentavalent as the hot spring water flows to the river, and at the intake point most arsenic is pentavalent. And after pre-chlorination, most arsenic becomes pentavalent in filter. Through the water treatment process of the water treatment plant, the arsenic concentration

falls below the water quality standard value.

However, it is impossible to completely eliminate arsenic by the general water treatment method. If the coagulation effect worsens, the arsenic removal rate will go down. Of course, if the arsenic concentration of the raw water becomes high, the residual arsenic concentration will also rise. For these reasons, when removing arsenic through coagulation and sedimentation process, the following caution is required.

1. Monitor the state of arsenic in raw water (including whether it is pentavalent or trivalent).
2. Arsenic is converted from trivalent to pentavalent by chlorine treatment before filtration.
3. In order to grasp the state of coagulation and change of arsenic concentration, it is necessary to confirm the relation between the injection amount of the coagulant and arsenic concentration by jar test. Arsenic analysis may be difficult in developing countries. Analysis of each shape of arsenic is even more difficult. Therefore, it is necessary to pay close attention to the processing situation of the water treatment plant. From the above point of view, I do not think that "arsenic can be efficiently removed by coagulation and sedimentation treatment". First of all, correct recognition of arsenic concentration in raw water is important. As a second measure, it is best not to use a water source that contains arsenic for water supply. However, if there is no other water source, it is necessary to review the removal method including the water treatment process. Of course, the cost is a big condition in all ways. There is also a method of mixing with other water sources that do not contain arsenic. (A2, Answerer：Mr. KUDO Yukio、 JWWA、2009)

A3: As a result of water quality analysis of Mekong River in Vientiane, Laos, arsenic is not detected. (A3, Answerer: Mr. UKAI Tomohiro, JICA Laos Volunteer, 2009)

A4: Phnom Penh Water Supply Authority, Cambodia uses Mekong River. Arsenic is much less than Cambodian standard according to the data.

(A4, Answerer: Ms. YARIUCHI Mina, JICA ,2009)