Q&A

21Q6: We want to change the disinfectant from the chlorine (Cl_2) gas into sodium hypochlorite (NaClO) by thinking about safety in our water treatment plant. NaClO is used in a lot of water treatment plants in Japan. Please teach following.

1) **Comparison between Cl_2 gas and NaClO (characteristic, easiness of O&M, cost)**
2) **How many grams of commercial NaClO correspond to the Cl_2 gas 1g?**

A1: This answer was quoted from "Design Criteria for Waterworks Facilities 1990, Japan" used for the JICA Training Courses

(Ms.Yamamoto. WaQuAC-Net Office)

Chlorine agents include liquefied Cl_2, NaClO and calcium hypochlorite (including the high-grade bleaching powder). Additionally, sometimes, NaClO is produced by electrolysis at purification plants.

a. Liquefied Cl_2 is the liquefied Cl_2 gas charged in a container. Since Cl_2 gas is heavier than air, has pungent odor and strong toxicity, handling should be taken with thorough care while strictly observing legal requirement. For quality, as the available Cl_2 in liquefied Cl_2 is nearly 100%, the quality is stable, and compared with other chlorine agents, the storage capacity can be smaller.

b. Commercial NaClO is a pale yellow liquid with an available Cl_2 concentration of 5-12% and has strong alkalinity. The higher the concentration is, the more the stability is decreased and available Cl_2 is lost during storage. Compared with liquefied Cl_2, both the safety and ease of handling is better. However, since bubbles (oxygen) separated from the solution accumulate in the pipes and the pumps, which may disturb the flow of the solution, thorough consideration is required.

c. NaClO produced by a house generation system (by electrolysis) is a thin solution with 1% or less of available Cl_2 concentration. Accordingly, it is relatively free from bubble troubles compared with the commercial

NaClO but the facility is complicated. When selecting a chlorine agent, in addition to the above-mentioned characteristics of different chlorine agents, it is necessary to take into account the relative ease of maintenance and safety performance of the facility in case of disasters. Generally, it is desirable to use a commercial or house generated NaClO. Sometimes, house generated NaClO is used for avoiding secondary disaster by traffic accident.

A2: Case of K City in Japan

With regard to the change of Cl2 gas to NaClO;

1. The first reason was safety. Before changing, we used 19 containers of Cl_2 gas (50kg/ a container). When staffs changed a container, a very little gas leaked normally and we worried their health. When staff had to change the container in the midnight or weekend, the risk for staffs increased, because staff numbers in midnight and weekend were less than in the daytime of weekday.
2. The second reason was high cost and heavy workload by maintaining the chlorine dosing pipe and regular testing the container capacity to resist pressure. And also these works were complicated.
3. The third reason was the change of living environment in the surround of a water treatment plant (WTP). And awareness of people living near WTP changed. Now WTPs are not located in a desolated field like before. Houses and factories increased near the WTPs and we worried big accident and considered people's fear.

When we compare the actual consumption of Cl2 gas in 1993/ 1994 with the actual consumption of NaClO in 2007/ 2008 in K City, Cl_2 gas 3.6g was consumed for treated water 1m^3 in average and NaClO consumption was 21.0g (as 12% of concentration) as well.

(Answerer: Mr. ODASHIMA Akihiko, Kitakami City Waterworks Department, 2011)

A3: Case of KQ City in Japan

Commercial NaClO contains 13% of chlorine concentration. However, while NaClO is in the storage, the concentration reduces to 10% around. If you keep it longer, it reduces to less than 10%.

We manage the stock of NaClO not to keep so long time in storage. We calculate dosing rate using 12% of chlorine concentration. Eight point three (8.3) times of NaClO in weight correspond to Cl_2 gas.

(Answerer: Mr. KAGATA Katsutosh, Kitakyushu Water and sewage works association,2011)