Indemnification of the quality of water supply in residential areas

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Abstract: Most cities of our country now adopt the method of concentative pipe nets in water supply. In order to meet the users' request of hydraulic pressure, some small residential areas or building groups have established water supply systems of secondary compression. Now most water supply enterprises do much work in purification processes of waterworks so as to improve the water quality; however, the secondary pollution because of water supply pipe nets is ignored. An investigation was done by special team of "security technology of water quality in residential areas" and they investigated water quality of waterworks and health and quarantine stations in big and middle cities of the whole country. The result indicates that secondary pollution of pipeline networks indeed exists. So, in order to resolve the question of secondary pollution and to provide people with clean and secure drinking water, the reason that secondary pollution came into being must be understood, moreover, concrete methods and measures aimed at each reason should be found out.

Keywords: drinking water, secondary pollution, water quality

1. Quality of tap water

Our country promulgated "sanitary criterion of drinking water" to ensure the tap water quality of city and to evaluate whether it is excellent and secure or not. According to our country's situation, department of construction constituted technology development layout of 2000 of water supply enterprises, which requires that in large scale water supply companies the comprehensive ratio of water quality that reach standard should reach 95.94% by 2000, in middle scale water supply companies the ratio should reach 92.37%, other water supply corporations should reach 85% [1,2].

In the engineering project with science and technology of well-to-do residence in 1997, special team of "security technology of water quality in residential areas" made an investigation on the quality of factory water, pipeline network water and the water of adjustive pool used for secondary compression, water tank and water-using points of residential areas, etc. The data indicate that: the quality of water supplied by tap water corporations in big and middle cities of our country is up to the criterion of drinking water on the whole, although the water in pipe nets received secondary pollution and the water quality declined compared with that just left factory to some extent. In adjustive pools of secondary compression in residential areas, water towers and water tanks the secondary pollution is even worse, and on places that residenters use water and branches of pipe, the water quality has declined obviously with many indexes' mean value exceeding the criterion[3].

2. The reason of secondary pollution of drinking water

2.1 Corruption, deposition and dirt inside the pipe are one reason of secondary pollution, and they are usually brought forth by the following elements:

Calcium and magnesium ions in natural water combine with carbonic acid ions and form CaCO3 and Mg(OH)2 which are hardly dissolved in water, so furring and sediment would be formed.

Because the chemical corrosion and electrochemical corrosion caused by water's erosion to the inside wall of metal pipe may bring about hydrates which accumulate inside the pipe to form accidented oxide sedimentation on the exterior.

Too much iron in water may lead the sediment to fill in the pipe.

Biologic jam inside the pipe. Through analysis of jam sediments in the pipe, we found that there are microorganism and organic alga elements. These infinitesimal live organic substances may reproduce and accumulate when provided with favorable living factors.

Suspended solids on water may deposit and form sediment.

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2.2 Effusion from the corrosion protection lining can pollute the water.

Galvanized steel tube, especially cold-galvanized steel tube has very bad effect on our health. When the layer of galvanization sheds, the metal pipe cannot be protected from corrupted, moreover, the content of zinc in water be increased.

Asphaltum lining may lead the increasing of indexes in water such as benzenes, volatile hydroxybenzene and total radioactivity and so on.

American Water Works Association (AWWA) reports: If cement mortar lining is treated with improperly the exudation would deteriorate water quality [4].

2.3 Pollution of water quality because of remaining chlorine.

A small quantity of dissociative remaining chlorine in pipe nets is good for the sterilization of water, but it may also acts with organic substances of secondary pollution and produces various organic chlorines some of which are carcinogens definitely. In 1997 through analysis of an investigation[5], we found that if one place which has high quantity of remaining chlorine when it leave water plant while has low quantity in water-using points then the index value of chloroform and carbon tetrachloride would increase very high.

2.4 The pollution of pipeline network water quality because of environmental factors.

When the ektexine of pipes buried underground corrupts and becomes perforated, the interface is not close and uneven settlement takes place or water leaks from interfaces, besides without mend, then once pressure loses or water supply cuts off, the exterior sewage would filter into the pipe.

Polluted water will filter into the pipe when valve leaks or be sucked into the pipe by auto-vent valve while it is dipped in by sewage.

If drinking water pipes are connected with non-drinking water pipes or non-city tap water pipes, and valves or back valves are not close, then water of other pipe nets would enter the pipe of drinking water and pollutes it.

2.5 Pollution of pipeline water due to that pipeline network is not administered well

When pipeline laying is completed, the pipelines is not soaked with disinfectant or be swashed with high speed with rinsing thus causing bad effect on water quality of the whole pipeline network after put into practice.

The lentic areas, terminals of pipelines and other parts are not discharged or swashed periodically, causing the water quality of the lentic areas declining.

The cleaning up, scraping of pipes and lining inside pipes do not go on periodically.

2.6 Secondary contamination caused by water storing and adjustive equipments

Because of the structural irrationality of water storing equipments and that the pressure pipes or drainage pipes are out of place, phenomena of short circuit of water or dead water areas inside the pool often occur[6].

Design and calculation of water storing equipments do not carry out reasonably, for example, when only the security is taken into account, the equipment schemed out would be so huge in dimension and the water would rest so long in it, thereby this would affect water quality.

Water storing equipments are out of place, no measures are adopted to prevent vent holes from being polluted, manhole covers are not pressurized and equipments underground have no measures against leakage can all cause outside contamination to enter equipments and result in severe secondary pollution.

The water quality certainly will deteriorates step by step with the water storing equipments misgoverned, in disrepair and disclearing for so long a time.

Chengtu Water Co. surveyed the water quality change at different storage time and in different water tanks made of armor plate, glass and reinforced concrete respectively. The result revealed the common physical and chemical indexes and toxicological indexes have no obvious difference except that the content of iron and manganese in tank made of iron increase appreciably. After stockpiled in tank for 24 hours, the quantity of remaining chlorine in water would reduce to zero. Especially in summer, the temperature of water is relatively high, the remaining chlorine diminishing quickly, reaching zero after 12 h, so this kind of water is not fit for drinking immediately. in water

3. Technological measures to prevent water quality of residential areas from secondary pollution

3.1 Improve the quality of water leaving factory and eliminate hidden dangers of secondary pollution in system of pipelines.

Low turbidity not only meets the requirement of sense organ but also is very important in reducing the viruses, bacteria and organic substances in pipelines. Some research information indicated that when the turbidity value is 2.5 NTU, 27.3 % of the organic substances in the water are eliminated; and when the turbidity reduces to 1.5 NTU, 60 % of the organic substances are eliminated; then when the turbidity value decreases to 0.5 NTU, 79.6 % of the organic substances are eliminated; at last when the turbidity value reduces to 0.1 NTU, most of the organic substances are eliminated and microorganisms that cause diseases are also decreased greatly.

Improve on water treatment process and take measures to make water quality steady. For example, if pH value is adjusted between 7 to 8.5 by putting stabilizing agent into water, the water stability can be greatly increased. This method is widely used in Europe, American and other developed countries, and is obtaining good results.

Biological treatment and adsorption on active carbon can also increase biological stability of water. Biological treatment is very effective in eliminating the organic substances in water and above 90 % of the AOC may be eliminated. The familiar contaminations from chemical factories such as aromatic hydrocarbon, chlorobenzene, hydroxybenzene and chloridizing aliphatic series can all be degraded with this method of biomembrane. Research reveals that biological treatment after mixture, flocculation and deposition can ensure to obtain water with biological stability. In this way organic substances which may cause mutation can be eliminated to some extent, and the biological stability of drinking water can also be greatly increased. This method can make water stockpiled in pipelines for a longer time without deterioration and is an effective and practical technique.

Chose disinfectant reasonably. In recent years, researches have indicated that chloramine is more effective than free chlorine in the aspect of controlling biomembrane. Even if the concentration of free remaining chlorine is (3−4) mg/L it has little effect on controlling biomembrane, while remaining chloramine can successfully decrease numbers of live bacterium as long as it's concentration is above 2 mg/L. Therefore chloramine is effective than free chlorine in sterilization. In American, above 70 % of the water works use chloramine as disinfectant.

3.2 Adopting newfashioned plastic water supply pipes

In residential areas, water using mainly concentrates in a few periods of time, and at the rest time water basically stagnates in branch pipes of small calibre or pipes inside house, which is in favor of the conglutination and increasing steadily of micro-organisms after random impact, and makes pipes erode in a relative short time. Considering that these pipes require not very high in pressure, newfashioned plastic water supply pipes which resist corruption and have slippery intine can be adopted

3.3 Applicable design of secondary water supply equipment and effective operation management

From the results of investigation, we can find that the quality of water effused from secondary water supply equipments declined severely and resulted in accelerated erosion of pipes inside the house. Therefore we must pay attention to the design of secondary water supply equipments and strengthen the run administration. Especially, we must attend importance to the work of cleanout and sterilization periodically and research works of erosion controlling of water storing materials and timely adjustment of water-storage capacity.

3.4 Reconstruct the subcritical flow regions and other regions

Erosion of pipeline networks are closely connected with the flow regime of water in pipe. While estimating the whole system of pipelines, we should manage to reconstruct the subcritical flow regions and other regions where questions of water quality possibly occur in order to supply water evenly over the whole range.

3.5 Regular swashing and disinfection

Water supply departments must pay attention to the erosion problem of pipeline networks. In sections exposed to severe erosion, swashing work should be done often and the dosage of disinfector should be

increased properly at the same time to kill microorganisms that suspend again after being rinsed. Inhibitor of corrosion are suggested to be used after rinse so as to accelerate the protective membrane to form in the internal surface area of the pipes. If corrosion products accumulated in pipes arose severe decline in ability of water flow, then scraping and lining of pipes should be done designedly.

3.6 High erosion-resistance water faucets and valves

Water faucets and valves are parts that receive the severest corrosion in the pipeline system because water erosion and gas erosion exist at the same time and this wears down materials acceleratedly. In order to prevent water from deteriorating at end users, Water faucets and valves with high erosion resistance should be employed widely.

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