ANHYDROUS AMMONIA

IN CHLORINE SYSTEMS
AND THE FORMATION OF CHLORAMINES

One of the important steps in the treatment of a water supply is chlorination. Most objectionable odors and tastes present can be removed while disinfecting water with chlorine gas during the treatment process. Chlorine also inactivates undesirable materials sometimes present in water such as sulfides, sulfites, ferrous iron, miscellaneous organic matter, etc.

In large open reservoirs, it is difficult to maintain the necessary level of chlorine due to the fact that it combines with organic matter and is dissipated in sunlight. In order to maintain a desired chlorine level, anhydrous ammonia can be added before the chlorination step. This complexes the chlorine in the form of chloramines. Treatment of water with chloramines is referred to as chloramination, or contained residual chloramination. The actual reactions involved with ***the formation of chloramines*** are:

FORMATION OF AMMONIUM HYDROXIDE

NH_3	+	**H_20**	→	**NH_4OH**
Anhydrous Ammonia		Water		Ammonium Hydroxide

FORMATION OF HYPOCHLOROUS ACID

Cl_2	+	**H_20**	→	**HOCl**
Chlorine		Water		Hypochlorous Acid

FORMATION OF MONOCHLORAMINE

NH_4OH	+	**HOCl**	→	**NH_2Cl**
Ammonium Hydroxide		Hypochlorous Acid		Monochloramine

FORMATION OF DICHLORAMINE

NH_2Cl	+	**HOCl**	→	**$NHCl_2$**
Monochloramine		Hypochlorous Acid		Dichloramine

The ratio of monochloramine to dichloramine is dependent upon the pH of the water being treated. At a pH of 8.5, monochloramine is the only compound formed. At a pH of 5.0, dichloramine is the only compound formed.

Each water system must be analyzed individually to determine if the addition of ammonia is required in the disinfection process. Such things as reservoir size and ammonia content of raw water must be considered. The ratio of chlorine to ammonia required for the formation of chloramines varies from 8:1 to 1:1, depending upon the amount of ammonia present in the raw water. At a ratio of 10:1 the chlorine will tend to oxidize ammonia to form nitrogen and water.

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