Technical Information:

Date: February 2006
Subject: Water Treatment Chlorine Dioxide
Topic : Chlorine Dioxide Consumption

When sizing a Chlorine Dioxide generator for an application, a detailed water analysis can help to determine what size of a unit should be used or if some further testing is required.

A typical water analysis will give the inorganic substances, the main points of interest are Iron, Manganese Nitrite and Sulphide (Hydrogen Sulphide).

Chlorine Dioxide will be consumed by these species as follows.

1 ppm Iron consumes 1.2 ppm ClO_2
$Fe^{2+} + ClO_2 + 3\ H_2O \rightarrow Fe(OH)_3\downarrow + ClO_2^- + 3\ H^+$
The Iron hydroxide will precipitate and need to be filtered.

1 ppm Manganese consumes 2.5 ppm ClO_2
$Mn^{2+} + ClO_2 + 2\ H_2O \rightarrow MnO_2\downarrow + ClO_2^- + 4\ H^+$
Manganese as Manganese dioxide will precipitate and need to be filtered

1 ppm Nitrite consumes 2.9 ppm ClO_2
$NO_2^- + 2\ ClO_2 + H_2O \rightarrow NO_3^- + 2\ ClO_2^- + 2\ H^+$
Nitrite is oxidized to Nitrate,

1 ppm Sulphide consumes 2.1 ppm ClO_2
$2\ S^- + 2\ ClO_2 \rightarrow SO_4^{2-} + S\downarrow + 2\ Cl^-$
Sulphide to Sulphate + Sulphur
(Here Hydrogen Sulphide is shown as Sulphide S^-)

Note that the oxidation of Iron, Manganese, Nitrite will directly produce Chlorite, the MAC (**M**aximum **A**llowable **C**oncentration) of Chlorite in potable water is 1.0 PPM.

If the application for Chlorine dioxide is drinking water and the Chlorite predictably will exceed the MAC, provisions should be made to either remove the Chlorite or use an additional method of pre-oxidation.

Also important is the organic content of the water, unfortunately the consumption of Chlorine Dioxide can't really be fully determined unless a lab test is done to a water sample. This is done by adding a prepared Chlorine Dioxide solution gradually to the water sample until a residual reading is present.

From this an approximation of the Chlorine Dioxide consumption can be determined and a unit sized for an appropriate residual.

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