Chlorine dioxide is a powerful disinfectant and produces less by-products than alternative disinfection methods. At a pH value of about 7.5 chlorine dioxide is more effective than chlorine and hypochlorite. That is why chlorine dioxide is used in water treatment for corrosion stable water (pH > 7.7, and free carbonic acid < 5 mg/l).

Generation methods
Chlorine dioxide is produced as an aqueous solution of constant strength. For the generation, either the acid-chlorite or the chlorine-chlorite methods can be used. The strength of the two basic chemicals is balanced in a ratio that ensures an optimal yield of chlorine dioxide. The chlorine dioxide solution produced can either be directly metered via an injection unit into the water to be treated or can be offered as a batch system.

The use of hydrochloric acid in generators based on the acid method
While the boiling point of 38 % hydrochloric acid is 50 ° C, it is 110 ° C for 30 % hydrochloric acid. Therefore, 30 % hydrochloric acid is preferred at a higher ambient temperature. Due to the lower vapor pressure of the loss of active ingredient and the consumption of neutralizing agents is lower when 30 % hydrochloric acid is used.
The use of sodium chlorite in both generation methods (acid-chlorite, chlorine-chlorite)
In solid form sodium chlorite is oxidizing. Only as solution it can be stored stable and safely. It is used in concentrations of 7.5 and 24.5 – 31%. The tanks should be secured with a suitable sized collection basin, in case of using concentrated solutions with controlled leak detectors.

The modern drinking water treatment is based on the setting low-corrosion, stable waters with a pH value $\geq 7.7$ and a content of free carbonic acid $<5$ mg/l (dark blue curve). At a pH $\geq 7.7$ (red line), the active, effective for disinfection, chlorine (dark red line) has only about a 40% share of the total chlorine content. On the other hand, chlorine dioxide (green line) remains active as dissolved gas.

Stability
The higher the concentration of the solution is, the faster chlorine dioxide decomposes. The optimum reaction time for chlorine dioxide production is 15 to 60 minutes in an acid-chlorite reaction. If this time is further exceeded, unwanted by-products might be formed.

Therefore, Evoqua Water Technologies can offer a batch production system for applications where the dosing is interrupted for more than 6 or 8 hours. This way the reaction time is thus kept in the optimum range. $\text{ClO}_2$ is stored as diluted solution, stable against possible disintegration. The batch method is also recommended for heavily fluctuating dosing needs.

Generator technology
The most suitable generator technology depends on the need for chlorine dioxide. There are direct feed systems as well as batch and large-scale installations.

Direct systems (DIOX-A 250) are used for continuous dosing and monitoring of chlorine dioxide. The starting substances are mixed at the appropriate concentration and react in a tubular reactor. Through the reaction tube, the necessary reaction time is observed. For the chlorite-hydrochloric acid method, this time takes 15 to 60 minutes. The concentration of chlorine dioxide is adjusted according the dosing needs to 1.5 to 3.0 g/l (standard: 2.0 g/l).

Batch systems: If the dosing is interrupted or the dosing requirement is fluctuating it is better to store the diluted solution in a batch tank and to serve several dosing points. At a concentration of 2 to 3 g/l, the stability is several days.

High capacity: When large amounts are needed, the chlorite/chlorine or the hydrochloric acid method are applicable and concentrated precursor chemicals are used. (DIOX-A 5000, DIOX-C up to 5 kg/h).