

## ABB Aztec 600 Fluoride analyzers

Achieving safe fluoridation through on-line monitoring



Protection against fluoride over-dosing, proof of legislative compliance and precise control of water fluoridation.

### Measurement made easy

### Introduction

In many parts of the world, fluoride is added to public water supplies to help improve dental health. Fluoride is found in all natural water to some degree. Surface waters generally have low concentrations of fluoride, typically around 0.5 mg/l. Groundwater may contain much higher levels of fluoride if it has been excessively exposed to inorganic minerals containing fluoride.

Studies have shown that the addition of low concentrations of fluoride of 1 mg/l can assist in reducing the incidence of tooth decay. However, the addition of fluoride to water is a controversial subject, with doses above 1.5 mg/l being linked to medical disorders such as dental and skeletal fluorosis and osteoporosis.

For this reason, the World Health Organization (WHO) has set an upper limit of 1.5 mg/l for fluoride in drinking water.

Given the potentially hazardous nature of the chemicals used in fluoridation and the potential consequences of over-fluoridation, the addition of fluoride to drinking water must be accurately controlled and carefully monitored to ensure that locally set operational criteria is adhered to.

## The application

Different types of chemicals may be used in fluoridation processes, the most common being disodium hexafluorosilicate ( $\text{Na}_2\text{SiF}_6$ ) and hexafluorosilicic acid ( $\text{H}_2\text{SiF}_6$ ), both of which pose a risk to human health and wildlife if not properly handled.

Figure 1 shows a typical water fluoridation treatment plant arrangement. In this example, hexafluorosilicic acid is held in a bulk storage tank (1) within a bunded area (2). Prior to use, the acid is passed through an automatic dilution plant (3) to reduce its concentration and help simplify control of dosing. From here, the diluted acid is passed to a separate tank (4), which holds around a day's supply of acid. As a

safeguard against overdosing caused by potential plant failure, this tank is topped up once only in any 24 hour period.

The dilute solution is pumped into the potable water supply by a fluoride injection pump (5) on the outlet line from the tank.

The sample to the fluoride monitor (6) is taken after the main supply pumps to ensure adequate mixing and to enable a representative sample to be taken. The pump speed is determined by the plant flow throughput and the pump stroke is controlled by the output from the monitor.

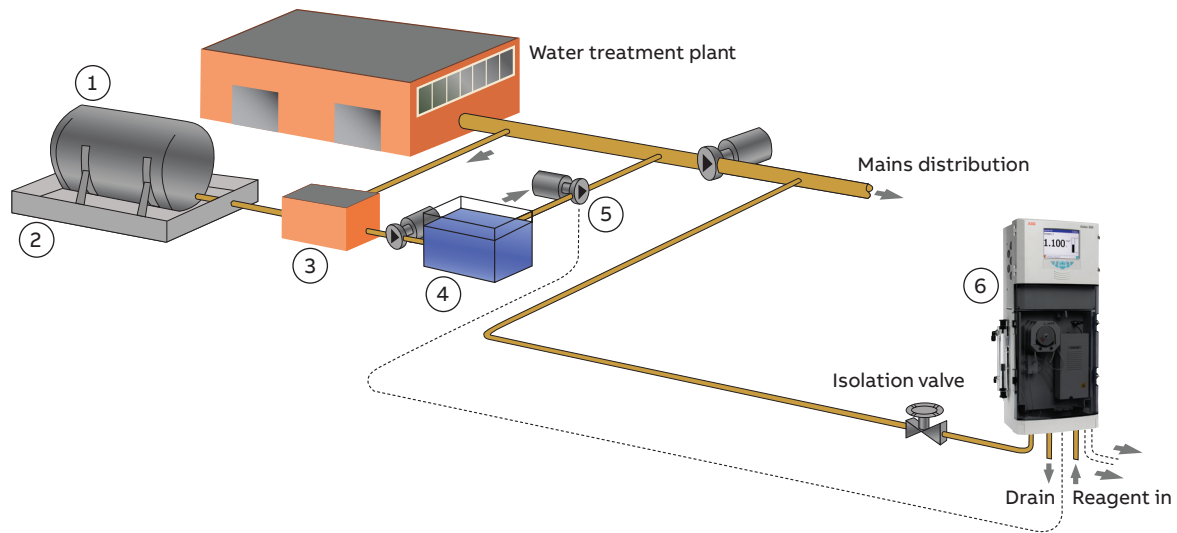


Figure 1 A typical water fluoridation treatment plant arrangement.

## The challenge

Accurate dosing of the chemicals used to fluoridate the water can be further complicated by underlying levels of natural fluoride in certain areas. In these areas, the dosing of chemicals to the water supply must be adjusted to take account of the existing natural background levels.

To help maximize accuracy, situate the sampling point for any on-line monitoring instrument in a location where the sample is likely to have been sufficiently mixed. Any sample must also be taken before the water is drawn off to the distribution network.

Given the potentially hazardous nature of the chemicals used in fluoridation and the consequences of over-fluoridation, water operators may also be required to demonstrate that they have been dosing within the required limits.

## The solution

ABB's Aztec 600 Fluoride analyzers provide accurate on-line monitoring of fluoride dosing in potable water applications.

Incorporating a range of features, including high and low level alarms, the Aztec 600 Fluoride offers reliable and accurate on-line analysis of fluoride concentrations, allowing immediate process decisions to be made to help preserve the safety of the treatment process.

By utilizing the same common platform as the Aztec colorimetric range, the Aztec 600 Fluoride is able to store data on the fluoride dosing process. This data can be retrieved in a number of ways. A built-in Ethernet communications link with on-board web and FTP servers enables remote monitoring, configuration selection, data and log file access to the analyzer from a web browser, whilst the option of Profibus DP allows access over a fieldbus network.

## The Aztec 600 Fluoride

The Aztec 600 ISE fluoride analyzer measures total solubilized fluoride using a combination fluoride ion-selective electrode. This electrode combines the fluoride sensing electrode and the reference electrode into one body. When the electrode is immersed in a solution containing fluoride ions, the difference in fluoride ion activity across the membrane causes an electrical potential to be generated. The fluoride probe produces an output that is logarithmically related to the measured concentration.

It is important that the temperature of both the sample and the electrode are controlled to prevent any variations that could affect the electrode potential, resulting in significant measurement errors. The Aztec 600 ISE fluoride electrode is therefore housed in a fully enclosed temperature-controlled cell. This cell also helps to adjust and stabilize the sample temperature prior to the electrode, ensuring that a constant temperature is maintained during both calibration and measurement.

### How does the Aztec 600 Fluoride work?

A sample is first drawn from the sample chamber by the sample pump. In some drinking waters, there may be a residual of iron or aluminium from the chemical coagulants that have been added during the water treatment process. These metal ions can form a complex with the fluoride which can complicate the analysis.

To ensure an accurate measurement, the sample is pre-treated with a chemical buffer reagent before it is analyzed. This adjusts the ionic strength and buffers the sample pH. The reagent also contains a chelating agent which breaks up metal-fluoride complexes. This reagent is pumped into the sample line and mixed with the sample.

The conditioned sample is next passed through a temperature block to raise the temperature and provide further mixing before being presented to the fluoride electrode.

The electrode output is converted by the microprocessor to indicate the direct fluoride concentration in ppm, mg/l, ppb, g/l or in graphical format. Finally, the sample flows to waste.

To help operators to verify analyzer performance, the Aztec 600 Fluoride features automatic two-point calibration with separate high and low standard solutions. Calibration frequency can be programmed to occur either weekly or up to four times per day.

Aztec 600  
Fluoride



## Key features and benefits

The Aztec 600 Fluoride offers a range of features and benefits, providing users with a powerful, accurate and reliable tool for efficient monitoring and control of fluoride dosing in potable water treatment applications:

- **Improved process control**  
Enables operational decisions to be made in near real-time.
- **Enhanced process safety**  
The Aztec 600 Fluoride's built-in alarms help prevent incorrect dosing of fluoride which could otherwise harm human health. If the upper limit is exceeded, the monitor will automatically signal for the fluoridation process to be shut down.
- **Improved process reliability**  
Detect process failures before they affect the quality of the water leaving the plant.
- **Process optimization for water quality**  
Increased plant efficiency.
- **Potential capital and operating cost reductions**  
Reduced chemical and energy usage.
- **Continual monitoring of remote or un-staffed sites**  
Improved response times and reduced visits saving money and time whilst lowering carbon footprint.
- **Improved reporting**  
Analyzer audit trail data can be used to assure customers and regulators of process efficiency and consistent product quality.

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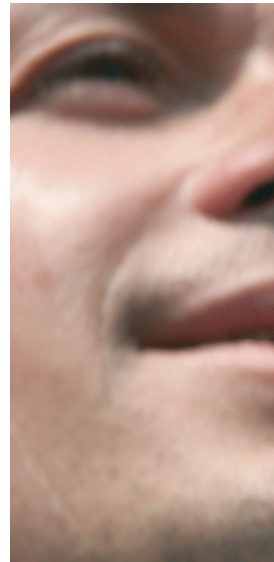
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