

# Foxboro® DolpHin™ pH Sensor

Recycling emissions control by-products

## Summary

The Foxboro® DolpHin™ pH sensors utilize a proprietary glass formulation for high temperature service, allowing use in applications with temperatures as high as 250°F (121°C).

## Business Value

Foxboro DolpHin sensors provide a service life up to five times longer than previous pH sensors, with accurate, reliable pH measurement in demanding applications. This reduces equipment and maintenance costs significantly, while increasing uptime and output.

## Benefits

- Accurate, reliable pH measurement in demanding applications
- Extended pH sensor service life
- Reduced maintenance and materials costs
- Improved production and operational efficiency
- Reduced waste disposal costs for environmental compliance



## About The Foxboro® pH Sensors

The Foxboro® DolpHin™ pH sensors utilize a proprietary glass formulation for high temperature service, allowing use in applications with temperatures as high as 250°F (121°C). These award-winning pH sensors also excel in temperature cycling applications where they outperform competitive probes in critical areas of lifetime, speed of response, and stability. Housed in chemical-resistant PVDF bodies, DolpHin sensors are available with a choice of measuring electrodes to meet various application criteria. Versions are available for pH or ORP measurement.

## Technical Challenge

Complying with EPA guidelines for reducing sulfur emissions leaves most power producers with additional calcium sulfite waste. Although not hazardous, calcium sulfite takes up space and major power utilities face the ongoing challenge of storing or otherwise disposing the calcium sulfite.

One Pennsylvania power plant was pumping the material through seven miles of pipeline to a company-owned holding reservoir, but was concerned that it would soon fill to capacity decided to search for an alternative solution. The company found a solution by developing a patented process that converts calcium sulfite into calcium sulfate, also known as gypsum. Gypsum is a marketable commodity with applications ranging from blackboard chalk to wallboard to toothpaste.

What does this power plant do with all this gypsum? It sells it to one of the leading gypsum wallboard producers in the world, whose plant is located across the street.

(continued)

## Technical Challenge (continued)

As early as 1975, the power plant voluntarily installed systems to reduce sulfur dioxide emissions by scrubbing the sulfur away in the exhaust flue gas. It sprays lime slurry into the exhaust flue gas and the calcium in the lime reacts with the sulfur to form calcium sulfite sludge. Instead of piping the sludge for storage, it is now sent to an oxidation tank, and using a Forced Oxidation Gypsum (FOG) process, is converted to gypsum. Critical to the process is maintaining pH around 5.

As the sludge leaves the oxidation column, it passes over pH sensors that detect acid levels for transmission back to a digital control system. If the probe detects pH significantly above 5, it transmits signals that trigger an additional flow rate of acid. If it detects readings below 5, it reduces the acid flow rate until the proper reading is obtained.

The sensors are exposed to thousands of tons of flowing sludge, which is maintained at temperatures of approximately 160°F (71°C). Moreover, the gypsum forms as a crystalline, very abrasive substance, which adds additional wear and tear. The power utility company installed three or four different pH sensor brands, but was unable to have one to last more than a few months. This added costs to the process, including the cost of labor and man-hours required to replace the sensors every month or so.

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## The Foxboro Solution

When Foxboro Measurements & Instruments created a rugged pH sensor that could last up to four times longer than conventional sensors, engineers at the Pennsylvania power facility tested the product and became one of the first sites in the world to implement a prototype. When it saw that the prototype lasted for four to six months it immediately standardized on the new DolpHin pH sensors, which was now in full production.

The complete Foxboro solution includes the DolpHin pH sensors installed in DolpHin ball valve insertion assemblies and wired to Foxboro 870ITPH intelligent pH transmitters. The DolpHin sensors have a unique pH glass formulation, which is proven to provide measurement stability, accuracy, and longer service life in high temperature applications up to 250°F (121°C). The pH glass also increases response speed up to five times and allows longer duty cycles. The reference electrode construction includes an ion barrier that protects and stabilizes the reference potential in harsh conditions. In addition, DolpHin electrodes are packaged in a rugged mechanical housing, which facilitates installation, removal, cleaning, and calibration.

## Results

Foxboro DolpHin sensors provide a service life up to five times longer than previous pH sensors, which reduces equipment and maintenance costs significantly, while increasing uptime and output. The DolpHin sensors also require less frequent calibration because of the probe's stability.

The DolpHin sensors improved pH measurement accuracy as well, since the accuracy of previous sensors began to degrade as they wore out. Reliable accuracy assures product quality while reducing materials costs since, if the pH is too high, the reaction will not take place, and gypsum is not produced. If the pH is too low, the process may be receiving more acid than required. Furthermore, the power company is under contract to deliver a specific amount of gypsum each month. Any inefficiency that prevents the plant from meeting those contractual obligations can also result in financial penalties.

However, the largest benefit is improvement that reduces the volume of dangerous waste materials and associated disposal costs, while supporting the company's commitment to long-term environmental compliance. It has found that the real gain is in reducing the amount of waste it has to store and estimate that the FOG process will buy it about ten more years of space in its storage reservoir.

In 2006, the utility constructed a second FOG plant and now uses 32 DolpHin sensors as part of the process to produce more than one million tons of synthetic gypsum annually, which eliminates almost all of the sludge that is produced.