Added Value of Wireless Data Transmission in Environmental Applications, Automated Compost Temperature Monitoring

Increasing needs for process control, as well as growing global environmental concerns, require companies and site operators to monitor and report a very wide variety of environmental conditions. These measurements take place within and around the industrial sites to provide accurate information to local and state regulatory departments. Most measurements concern gaseous emissions or effluent discharge and can be provided by all types of on-site instrumentation. Sensor data may include temperature, flow, pressure, and the composition of utilities, liquid, and exhaust discharged into the environment.

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Continuous improvement in wireless technology has made monitoring processes and environmental conditions in many locations much easier and safer with the development of autonomous devices. Personnel are no longer exposed to dangerous or unpleasant environments, and access to the data is possible at any time without sending personnel on site.

Today's industrial wireless technology is easy to install, power grid independent, and provides several configurations such as simple point to point, star, or tree network topologies where multiple sensors, instrumentation, and controllers can be connected over an entire plant. Innovative powerful wireless units are perfectly adapted to the growing need for environmental data collection on industrial and waste treatment sites, coupled with difficult access, multiple sensing points, and hazardous EX areas in water and waste applications. A safe and cost effective alternative to traditional cables, wireless sensing devices easily bring old installations to the new technological and regulatory standards and permits data acquisition leading to better process control and improvement.

In water and wastewater applications for example, Banner Engineering's wireless modules are used to transmit analogue or digital information from sensors and instrumentation located at difficult positions in the field: water undergoes several stages during its treatment process, from primary treatment to coagulation, flocculation, and clarification. Instrumentation and sensors are installed at several stages of the process. One sensitive point is measuring the sludge level in the clarification tank. Because the sensor is installed on the clarification tank bridge, communicating the sensor information back to the supervisor is done using slip rings that do not guarantee a reliable transmission and need frequent replacement. By using a wireless node, signals from multiple tanks can be transmitted up to several hundred meters to the main control room.

A case study in Industrial Composting

In modern composting, accurately monitoring the temperature inside the windrows is essential for efficient process control: directly correlated to the fermentation level, temperature increases until reaching a plateau, indicating optimal turning time and variations tell how to adapt the forced ventilation times that are specific to every site. To abide regulations and for safe use as fertiliser, measuring and recording temperature is essential. In Italy for example, regulation DM 5/2/98 requires three days above 55 °C to ensure pathogens are destroyed.

Based on the innovative battery operated wireless devices developed by Banner Engineering, a special temperature probe for compost permits an optimal monitoring of the temperature. Inserted at the very beginning of the fermentation process, the probe sends data every minute from the three sensing elements placed along the 1,5m plunger to the supervision. Data is displayed on a touchscreen controller and recorded. Formerly this was done by on-site reading that required an operator to climb on the piles to use a direct display probe or to download data from a local logger.

Alan SRL yearly composts 8 000T of digestate and green waste. The company is focused on process improvement and innovation; its plants are known for efficient operations and advanced application of technologies for biodigestion, biological wastewater treatment and energy recovery.

On its Zinasco plant, Alan SRL wanted to improve the process and visualisation of the temperature during the initial fermentation phase. The probes are situated inside an industrial concrete building, and the supervision and receiver are located 120 meters away. The site survey validated optimal positioning of a transmitter network between the fermentation building and the main office supervision that guarantees excellent communication conditions. M. Gatti, responsible of the biogas and composting plant says "the equipment has proven to be very reliable, without a single interruption in data measurement since begin of operations end of 2013"

Continuous monitoring quickly allowed the identification of a major improvement possibility on the operational side. The formerly slow fermentation phase required frequent attention from the site operatives. This could be solved through a thorough data analysis over several weeks, combined with the possibility to visualise the temperature gradient showing behavior differences between the top and bottom of the windrow. M. Gatti says: "Having permanent measuring allowed us to identify the reason for slow fermentation. Several adjustments were made in our process control with immediately visible results in a faster composting time (about 20%). Also, by adjusting the ventilation pattern, energy savings were possible, dividing consumption by 4".

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