Evolution in Environmental Monitoring and Added Value of Wireless Data Transmission

Increasing needs for process control, as well as the global growing 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.

> *"Regulatory agencies require landfill operators to measure and monitor the water levels within all ground wells in the landfill site, monitor leachate accumulation and removal, and accurately monitor methane gas production, removal, venting, and burning."*

Process monitoring requires having a global overview of operational figures, machine status, and utilities use. On the environmental side, most measurements concern gaseous emissions or effluent discharge. The environmental variables that must be recorded and reported vary depending upon each industrial site and activity. 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.

Bringing existing sites up to the new technological standards can be a time consuming and costly task because the power supply and signal wires to and from the sensors were not part of the original facility's plan. 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.

Continuous improvement in wireless technology has made monitoring process and environmental conditions in many hazardous locations much easier and safer with the development of autonomous and EX approved devices. Personnel are no longer exposed to dangerous or unpleasant environments and the frequency of manually monitoring or recording environmental readings from difficult-to-access locations has decreased.

Banner Engineering has developed a series of industrial wireless I/O solutions that range from self-contained, environmentally rated housings to embeddable board models designed to be installed into enclosures already in use at the site.

Environmental Monitoring Applications

Due to the configuration of waste, water, and wastewater treatment sites where distance between equipment can be important, and local power supply is not always guaranteed, wireless technology is particularity adapted to monitoring process and environmental data. These configurations are also commonly found in the oil and gas industries.

Water treatment plants

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.

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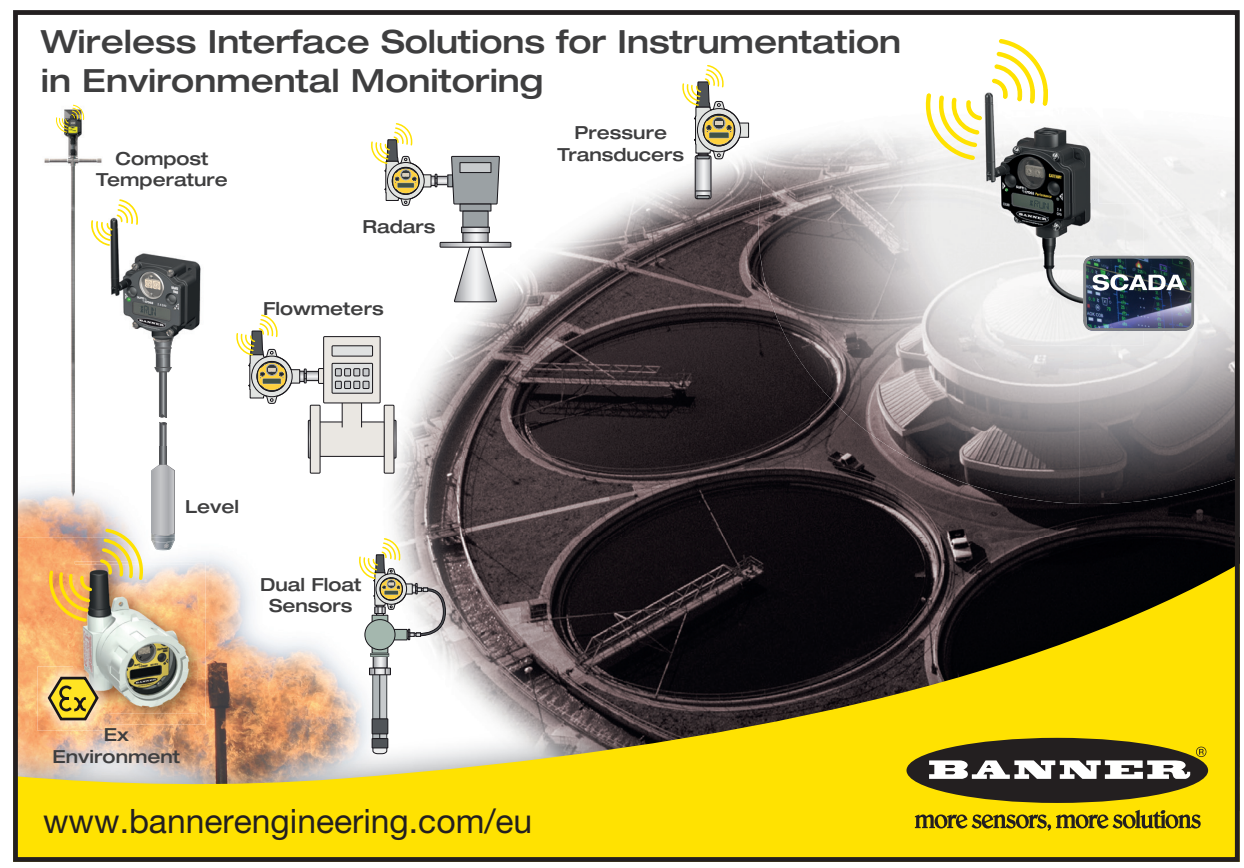

Banner Engineering – Wireless Interface Solutions for Instrumentation in Environmental Monitoring

Another common wireless application for factories or wastewater facilities is monitoring the temperature of the effluent discharge into the river and comparing it to the upstream water temperature. Although the distance from the river edge to the treatment plant is short, often there is no power at either data collection point and wiring can be cost prohibitive compared to the cost of the current wireless technology and temperature sensors.

River and Pond Level Control

Monitoring and controlling river, pond, and lake levels is an ideal example of using wireless technology in areas without access to wired power or data communication.

Radar gauges, encoders, and float systems connected to wireless devices are used to monitor lake levels. The wireless devices translate the level data back to a control center for logging and analysis. Submersible pressure sensors connected to wireless devices are also used to monitor retention pond levels. Level data is transmitted back to central control rooms for analysis to prevent retention ponds from overflowing during rainstorms or releasing the runoff into streams and rivers before it is tested for contaminants.

Landfill Leachate and Biogas Monitoring

Regulatory agencies require landfill operators to measure and monitor the water levels within all ground wells in the landfill site, monitor leachate accumulation and removal, and accurately monitor methane gas production, removal, venting, and burning.

Wireless devices connected with a counter input and submersible pressure sensor/transmitter reliably monitor both the leachate level and the pump. The submersible pressure transmitter monitors the leachate level while the pump strokes used to remove that leachate are counted. The sensor information is wirelessly transmitted to a host system that stores the data, performs calculations, or notifies personnel when a service vehicle is needed at a specific well.

Biogas wellheads equipped with a pressure sensor and wireless EX approved wireless node send back status signals on gas production for each individual well. Negative pressure within the methane production system is monitored and adjusted in real time, increasing efficiency and cost effectiveness. Thermocouples are used on the flare to monitor flame temperature and verify that the combustion of methane is ongoing. The wireless devices connected to both a pressure transducer and the temperature sensors collect the data and wirelessly transmit the data back to a host system for logging and analysis to comply with local, state, and federal regulations.

Anaerobic Digestion

Biodegradable material is digested by bacteria in a special tank. Depending on regulations, the produced biogas can be injected into the distribution grid and sent to a cogeneration unit to produce electricity and heat. During the process stages, it is necessary to measure the storage tank fill level, biogas pressure in the digester, flare status, and other parameters. Battery operated DX99 wireless units can help to monitor these values from the control room without having to run new cables.

Compost Temperature Management

To increase the efficiency of composting and ensure proper hygienisation, the temperature of the compost piles is measured and logged constantly through wireless temperature probes equipped with three sensing points.

Using wireless devices increases workplace safety because operators do not need to climb onto the piles several times a week to manually monitor the temperatures. Manually collecting this data is time consuming, introduces errors, and exposes the personnel to harmful pathogens.

Automatically collecting the data using sensors and wirelessly transmitting the data back to a centralized location allows composting temperatures to be continually recorded and logged, improving efficiency and reducing the time needed to complete a composting cycle.

Gas Detection in a Hazardous Environment

In a recent application, a major French gas detection company installed gas detectors on a UK client site to ensure employee safety around the plant and detect any hazardous situation. Due to the facility's size, running additional wires to the detectors situated far from the control room would have been complex and too expensive.

Instead, they equipped the sensors with a wireless OEM board. With this option, the signal from all detectors can be remotely monitored at all times, effectively protecting the site personnel and limiting the need to enter potentially dangerous areas.

Oil and Gas

Having a precise control of tanks volumes allows operating companies to efficiently coordinate fuel purchases with respect to fuel market fluctuations. It also helps avoid losses and inaccuracies caused by human errors. The exact measure of volume is not dependent only on level; mass, temperature, and density variations have also to be taken into consideration. Installation costs for this type of application can be very high because of the tank's remote location, which can be several

Banner Engineering - Wireless Radio Module

hundred meters apart, as well as being in an ATEX zone. Banner Engineering's wireless modules connected to the instrumentation will transmit the sensor signals back to the primary control location.

Slurry Pipeline Leak Monitoring

Coal slurry is the dirty water used to wash coal during mining. After the washing process is complete, the slurry is pumped to a slurry retention pond.

To prevent the slurry from entering streams and local water supplies, retention ponds are usually created within valleys between hills. While the slurry is pumped from the mine site over hills into the retention pond, the flow rates are measured at the origination site and at the retention pond. Sensors are also positioned at pipeline splices to detect leaks.

Wireless devices and flow sensors were mounted at each end of the pipeline to detect changes in the flow rates. Wireless devices and optical sensors were used at all pipeline splices to detect the presence of liquid. When a leak is detected, signals sent from the radios back to the control location shut down the slurry pumps to minimise the leaks.

Because the total length of the pipeline can be several miles, a wireless solution eliminates the need to run power and data cables the entire length of the pipeline. The wireless devices and their sensors can also be moved if the configuration of the pipeline ever changes.

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