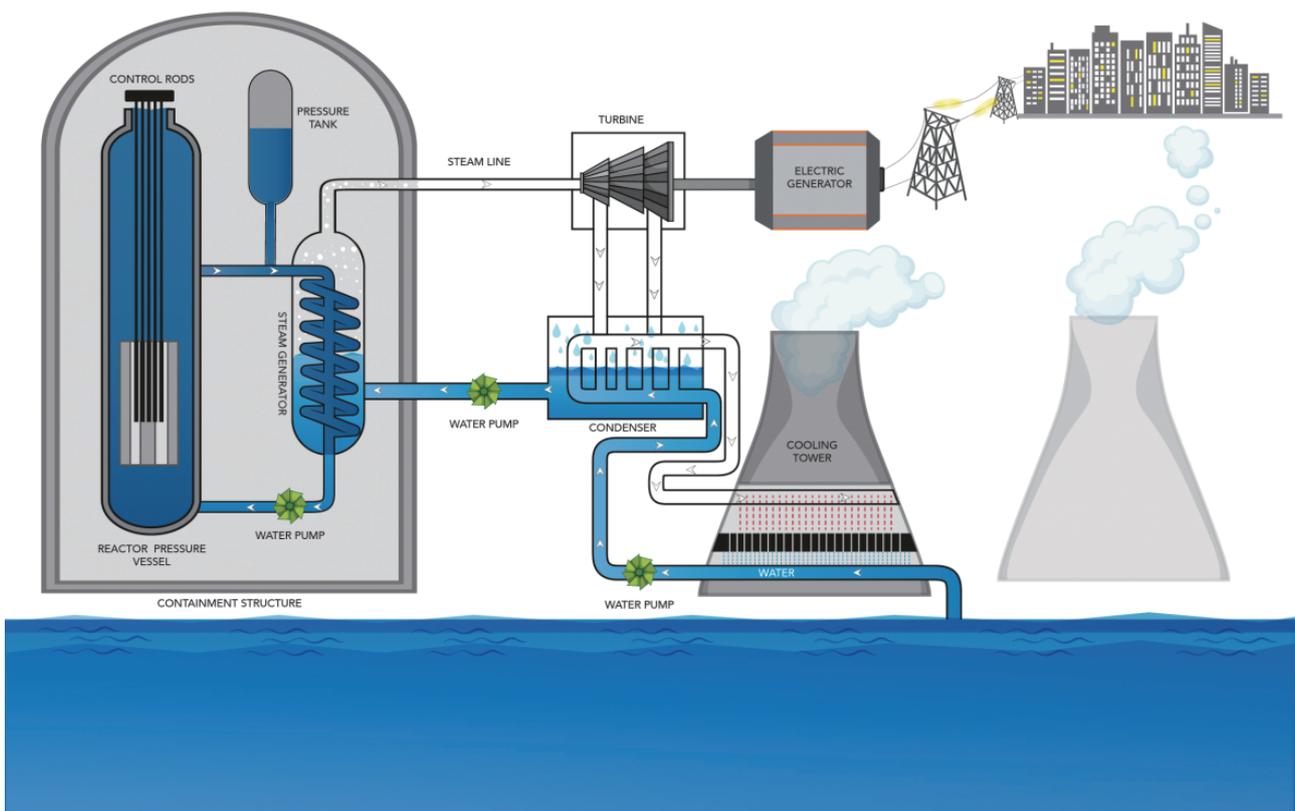




AVCOMM's Pioneering Solution for Pipeline Leak Monitoring in Nuclear Power Plants

Approximately 440 nuclear power units are operational globally, 92% of which are Light Water Reactors (LWRs). Of these LWRs, about 75% are Pressurized Water Reactors (PWRs), the most common commercial nuclear power reactor worldwide. AVCOMM has stepped up to support the nuclear power industry by providing a pipeline leak monitoring solution for these PWRs.

PRESSURIZED WATER REACTOR (PWR)



The Challenge

PWR nuclear power plants are often ideally situated near the sea, with favorable wind conditions and abundant beach/arable land. These conditions facilitate seawater usage for electricity generation and provide ample space for constructing factories and related facilities. Cooling towers, utilizing a circulating cooling method, draw in and release seawater through extensive pipelines.

However, due to the pipelines' length and numerous welding points, leakage is a common issue. Traditional pressure-based detection methods have proven inadequate, and a more thorough monitoring system is required to prevent soil harm from seawater leakage. The new system requires sensors that are resilient against harsh conditions, highly accurate, responsive, and capable of providing extensive data for leak detection.

•Harsh Operation Environment

(Device Material) Since the sensors need to be buried underground, they are vulnerable to erosion by rain, seawater, irrigation water and friction with stones.

(IP protection level) If dust or water gets inside the sensor, it can cause device failure.

•Accuracy of Data

When seawater leaks, sensors need to quickly and accurately detect data, and provide alarms to notify staff to repair and inspect pipeline. If the device reacts slowly and with low precision, it will lead to a situation where the soil has been severely eroded by seawater and remains undetected.

•Variety of Parameters

Since sensors buried underground are exposed to seawater, rainwater, and irrigation water, detecting only a single moisture content or salinity may lead to misjudgments and reduce work efficiency. Therefore, it is necessary to have multi-element integrated sensors for data detection and comprehensively determine whether seawater leaks from multiple data.

The Solution

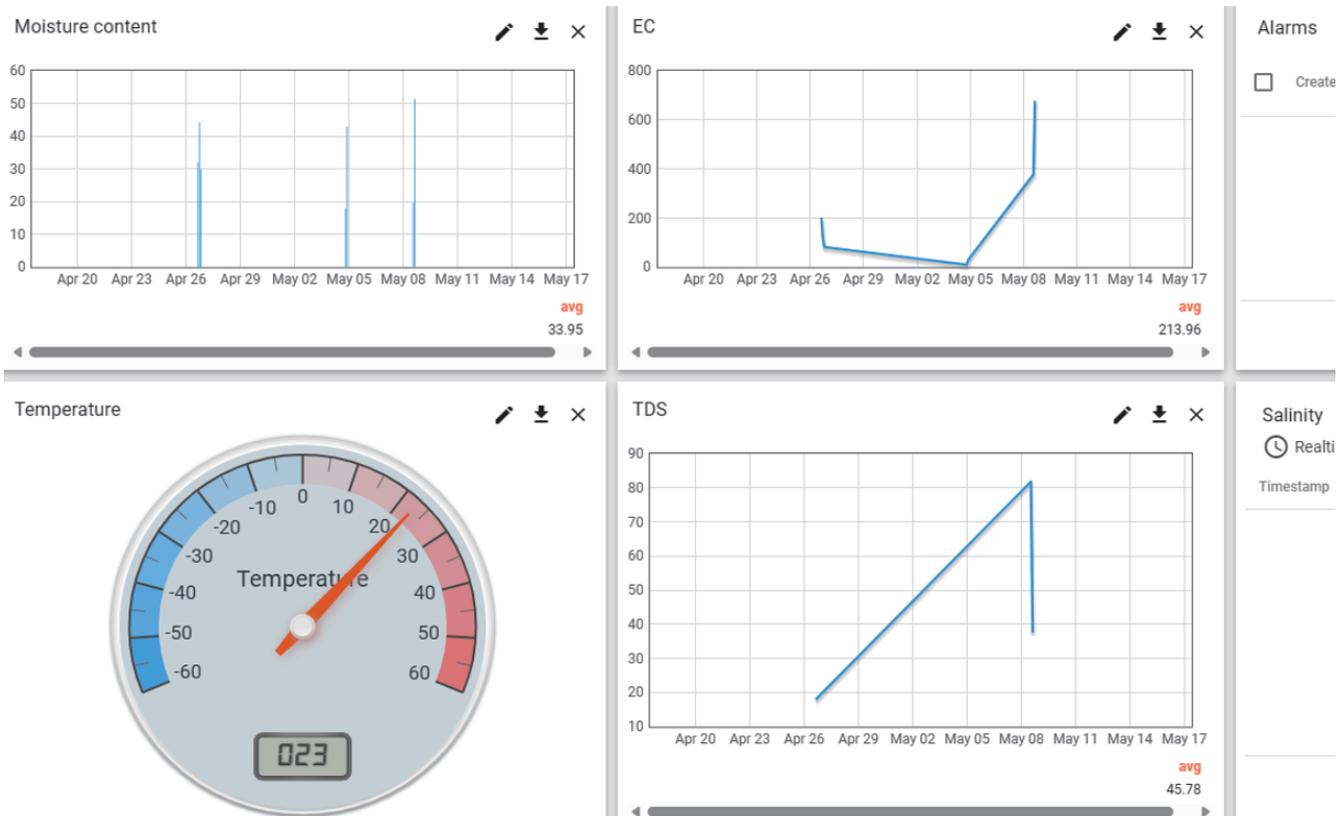
AVCOMM developed the AVC-ES-101SEC soil sensor, a fully sealed device resistant to both acid and alkali corrosion. With an IP68 protection level, it can be buried in the soil or submerged for long-term monitoring. The device boasts high precision, swift response, excellent interchangeability, and accurate measurements.



Distance between sensor and leakage site (m)	Moisture content (%)	Temperature (°C)	EC (us/cm)	TDS (ppm)	Salinity (ppt)
1	92.5	24.4	17.548	75.84	97.21
5	78.5	24.2	15.817	54.67	85.71
10	10.4	22.6	10.270	33.38	66.34

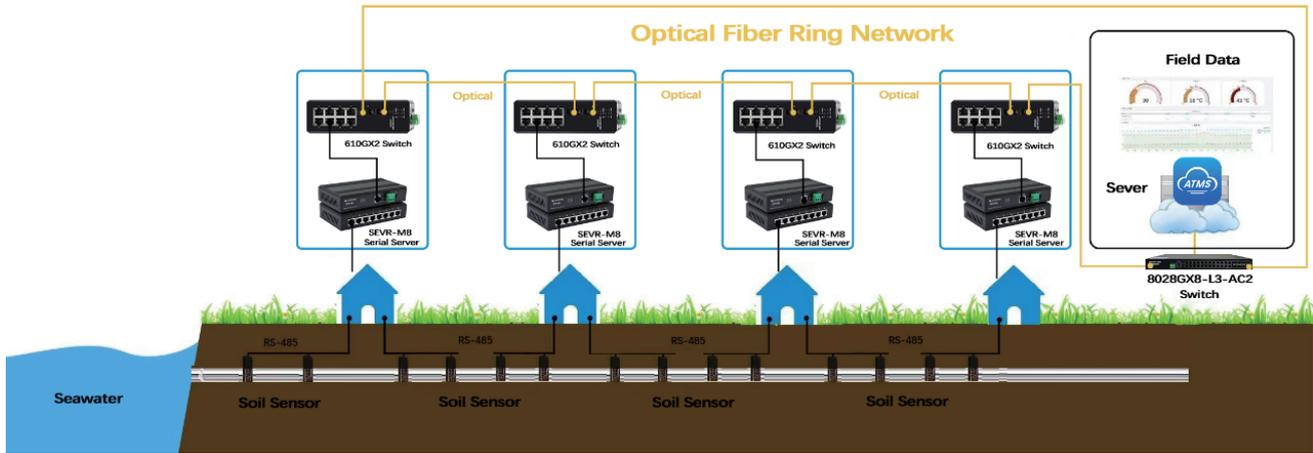
The AVC-ES101SEC soil sensor is also notable for its multiparametric capability. It detects true moisture content, EC, temperature, salinity, and TDS of various soils, all of which are vital parameters to discern the source of the water (rainwater, groundwater, irrigation water, or seawater).

Furthermore, AVCOMM’s ATMS IoT cloud platform collects sensor data and visualizes it. When the data reaches alarming levels, the platform notifies personnel to inspect and repair the pipeline promptly. MQTT and RESTful API for easy access to data from an Industrial IoT gateway. Real-time online monitoring, analysis and reporting. Remote cloud security and visual management. Flexible and secured access from any web browser either in PC or smart phone

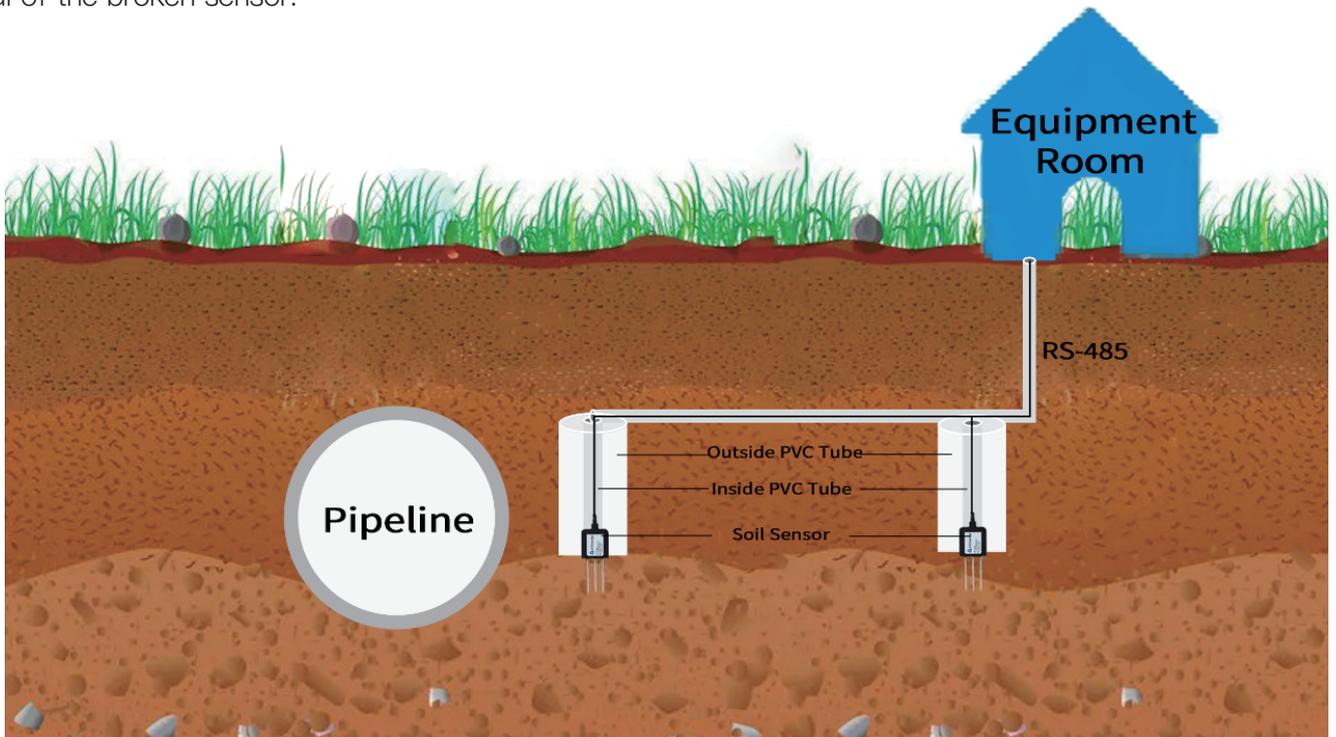


Transmission Method and Device Replacement

For the transmission method, we recommend using a serial server to connect the sensor via 485, then a switch to connect the serial server, and finally a ring network to be formed by optical fiber connection to the main server room for data collection. Furthermore, the soil sensor and 485 are buried underground, so there is no need to build a separate box on the ground to protect the devices.



For convenience and safety, we recommend that each sensor be connected to a PVC tube and a large PVC tube on the outside and finally connect them to the 485. When the sensor needs to be replaced, we simply dig up the soil and pull the small PVC tube out of the large PVC tube. Therefore, there is no need to dig too deep into the soil, which not only ensures the safety of the pipeline operation, but also makes sensor replacement more convenient. The sensor tube design is shown in the figure below. The larger PVC tube outside secures the surrounding soil to facilitate the insertion of the new sensor into the soil after replacement. The smaller PVC tube inside secures the sensor for direct removal of the broken sensor.



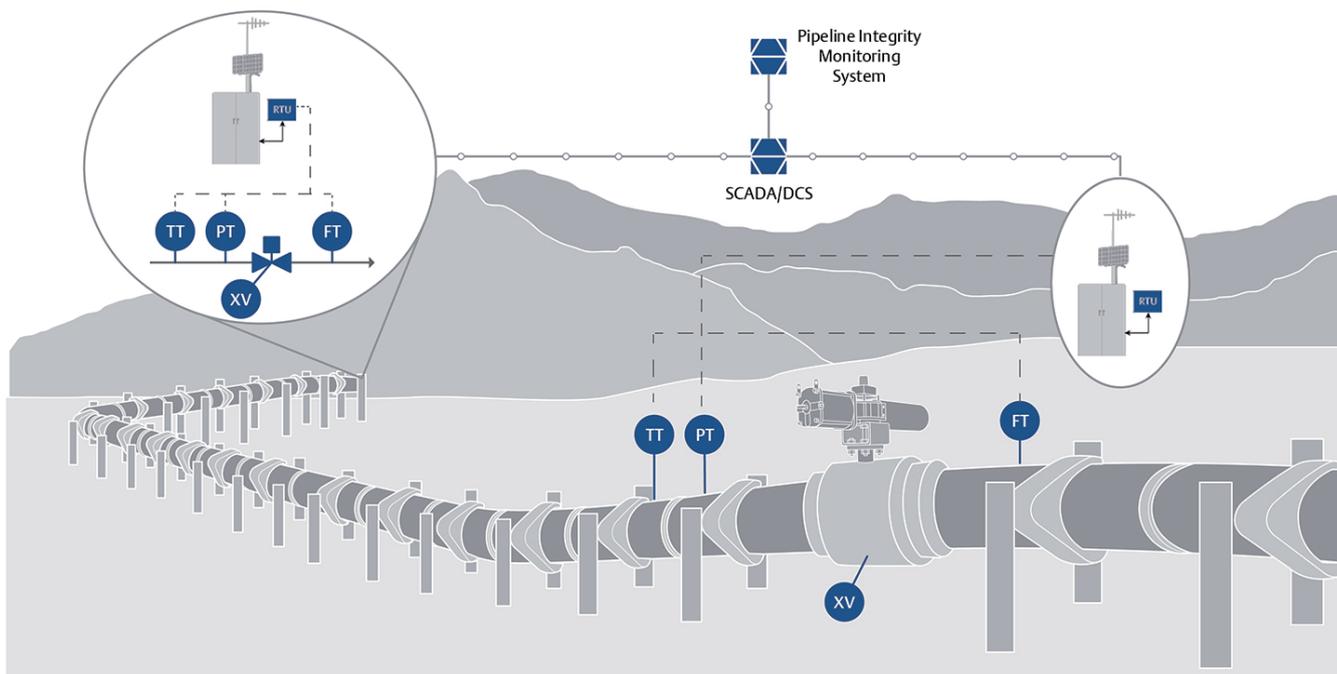
Value Delivered

The AVCOMM soil sensor provides:

Durability: Its specialized construction enables it to withstand harsh environments for extended periods. The IP68 rating ensures the device’s safe and proper functioning.

Accuracy and Alertness: The sensor responds swiftly, provides accurate data, and can detect anomalies in large data sets. The ATMS platform sends timely alerts based on accurate data, allowing for proactive pipeline maintenance.

Versatility: The sensor can measure multiple parameters, making it a comprehensive solution for monitoring pipeline leaks. It’s adaptability makes it fit for various environments and pipelines.



Future Outlook

Nuclear power, an efficient and reliable low-carbon energy source, holds significant development potential. With the increasing balance between renewable and traditional energies, nuclear power’s role in the global energy mix is expected to grow, particularly in regions with scarce electricity supply. Moreover, innovative technologies like AVCOMM’s pipeline leak monitoring solution enhance nuclear power’s safety and economic efficiency, thereby facilitating industrial upgrading and a green transition towards a low-carbon economy. In the long term, nuclear power will remain a crucial part of the global energy mix, promising more sustainable development.

Product Introduction

Soil sensor

<https://inc.avcomm.us/shop/avc-es101sec-2327?category=62#attr=>

Managed Switch

<https://inc.avcomm.us/shop/category/industrial-networking-fully-managed-600-series-31>

Serial Server

<https://inc.avcomm.us/shop/category/industrial-networking-serial-server-32>

Industrial IoT Platform—ATMS (Complimentary for Start)

<http://ota.avcomm.us>

L3 Switch

<https://inc.avcomm.us/shop/category/industrial-networking-layer-3-8000-l3-series-44>



Soil sensor



Managed Switch



Serial Server



ATMS Platform



L3 Switch

