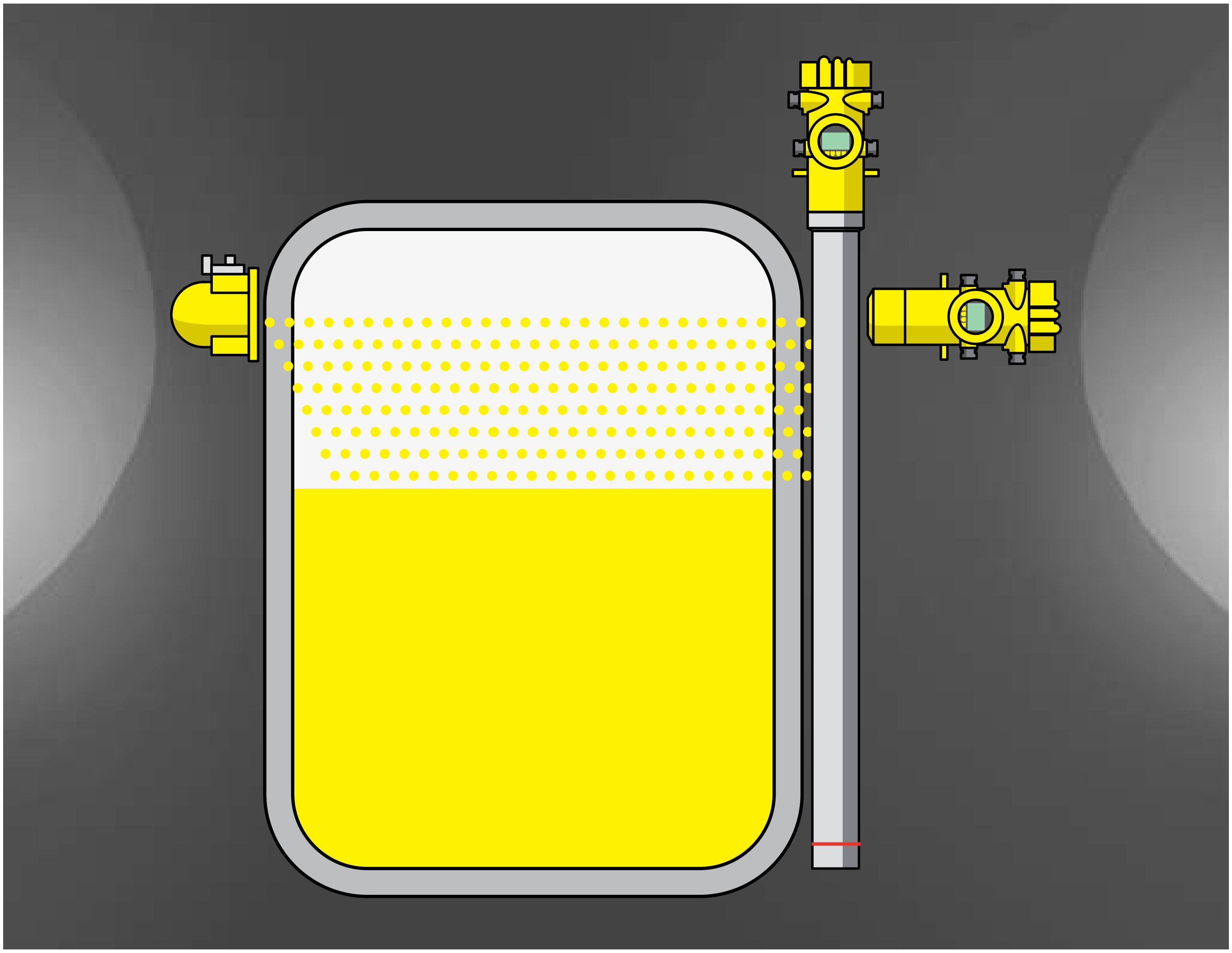

Level Measurement 101:

Demystifying Radiometric Level Measurement

Here's something you might not know: The process automation industry has been using radioactive material to make measurements since the 1950s. That's right, radiometric level measurement has been with us since the days of Elvis Presley, poodle skirts, and bobby socks. Despite its longevity and prominence in some of the world's largest industries, radiometric (or radiation-based) instrumentation is widely misunderstood. This paper seeks to demystify radiometric level measurement and answer some of the most common questions we hear about the technology.

Is radiometric level measurement safe?

This is *the* key question process automation professionals have about radiometric level measurement. In our experience, knowledge assauges safety concerns, so let's start our safety discussion with the basic building block of radiometric measurement technology, the radioactive isotope. An isotope may emit one of three different types of radiation: alpha, beta, or gamma. Many radiometric instruments use gamma radiation as a matter of practicality: Gamma rays penetrate aluminum, steel, and other industrial materials that alpha and beta radiation cannot always penetrate.

The low-intensity isotope, also called a source, is typically about the size of a dime and enclosed in a dense ceramic encasement. The ceramic encasement is double-contained in a stainless steel capsule designed to meet process automation's highest standards for safety. Capsules prevent contamination in the incredibly unlikely event a user should come into accidental contact with a source. A capsule is housed inside a steel- or lead-lined source holder on one side of a vessel or pipe inside a plant. The secure source holder shields the environment from radiation and collimates gamma energy so it is directed only at a detector mounted on the opposite side. Source holders arrive from the factory vigorously tested against heat, cold, leaking, and water, ensuring they can survive extreme conditions. These combined safety measures—the capsule and the source holder—severely limit exposure to radiation. There is a weak radiation field that surrounds a source holder if it is set in an "open" position, but that stray field creates less exposure to radiation than your typical dental x-ray.

How does radiometric level measurement work?

Radiometric level measurement sounds complicated, but it is relatively easy to understand. Gamma radiation emits from the source holder and the detector measures the radiation that reaches it. The number of sources and detectors and the rate of energy received will vary from application-to-application. As mass increases in the process, less radiation reaches the detector. More radioactive counts mean lower level, and fewer radioactive counts means higher level. The detector electronics use the gamma reading to infer a measurement and outputs the value. This is an important distinction for users to understand. Radiometric instruments do not directly measure the level of the material in the vessel; they measure energy from the source and infer level based upon that reading. For this reason, calibration is of the utmost importance.

What are advantages of radiometric instruments?

Radiometric sensors are used for continuous level and point-level monitoring in the most difficult solids and liquids applications because they measure without contacting the process material. This means there is no chance of damaging the detectors with harsh, abrasive, or corrosive products that would require frequent and expensive maintenance. Plus, the instruments are impervious to thermal shock, drastic pressure shifts, and other extreme process conditions. External mounting has the added benefit of allowing for installation during ongoing production. No plant wants to halt its process, with radiometric instruments, no plant has to.

Source holders, while heavy, are easy to install and mount. The detectors themselves are lightweight and can be mounted in a variety of positions to optimize the measurement. This ease of installation extends to retrofit applications as well as new ones.

What are disadvantages of radiometric instruments?

The sale of radioactive material is highly regulated and rightfully so. The extra regulatory burdens come at a financial cost and prolong the buying cycle. In the overwhelming majority of industrial applications, there are licenses to procure and training courses to complete. A plant cannot simply buy a radiometric measurement solution and go about its business. In fact, at VEGA Americas we have an entire group devoted to assisting customers with licensing and auditing their radiation safety programs. Beyond the regulatory costs, the material cost of radioactive isotopes is quite high compared with that of other level measurement solutions.

What are common applications for radiometric level measurement?

Radiometric level measurement instruments are used across the world in challenging applications. They are most prevalent in oil refining, where they measure viscous crude oil, coke in large drums, and catalyst in reformers. Inside chemical plants, radiometric sensors are used to measure level in reactors and separator vessels. The cement and power industries use these instruments to measure the level of bulk solids, and radiometric instruments are often found mounted to digesters in paper plants.

Conclusion

Radiometric level measurement is a viable option for automated processes involving difficult products and it has been since the 1950s. Non-contact and easy to mount, these instruments have a lot to offer to users willing to bear the associated financial and regulatory burdens. For the least stable products in the least predictable applications, radiometric technology is often the only one that will deliver reliable measurements. To see VEGA's line of radiometric level instruments, visit vega.com.

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