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## **Measuring Oil in Water: A Sanity Check**

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### **Abstract**

Reliable measurements of oil in water are becoming increasingly important to the petroleum industry. As the percent content of water in crude climbs higher, the need to increase the percent of oil recovered from the water treatment systems also climbs; efficiency in water removal corresponds directly to the bottom line for oil producers. Additionally, particularly on offshore platforms, there are stringent environmental regulations which need to be met.

The majority of well-proven techniques for measuring oil in water are “laboratory based”, typically using either gravimetric methods or IR (Infrared) Spectroscopy. However, lab-based measurements are too time-consuming for the realities of production environment. In particular, a water treatment system really needs to be monitored in several places in order to determine the efficacy of each treatment stage (and also for troubleshooting the process). This really requires an on-line or at least “at-line” monitoring approach for best results.

Over the years, several different methods have been proposed and used in the industry in order to accomplish real-time monitoring of oil in water content. Some of the more common methods tried include UV (ultraviolet) fluorescence, light obscuration, acoustic backscattering, IR absorption and digital imaging. All of these techniques claim to be able to measure oil in water accurately.

In this paper, we will take three actual instruments and compare their results against a standard EPA testing lab results. Solutions of known oil in water concentration were mixed in the laboratory, and samples of each were run through the different instruments and also sent in parallel to a certified EPA testing lab. The results were then plotted together to get a snapshot view of how each instrument did versus the results from the independent lab. The results show that all techniques exhibit variance, and that no two instruments produce the same result. The point of this exercise is not to “prove” that any one technique is more accurate. Rather, the point to be made is that manufacturers’ specifications for accuracy should be at least “calibrated” to known and accepted measurement techniques.

### **Why Measure Oil in Water?**

Reliable measurement of oil in water, particularly in produced water, is becoming increasingly more important. Initially, measurement of oil in produced water was being driven primarily by environmental regulations, particularly those imposed on offshore operations. However, as the world’s supply of oil becomes smaller, the price continues to rise and extraction is taking place on supplies having higher water content. In light of this, the need to more carefully monitor oil extraction from water has increased dramatically. Not only do the oil producers want to extract the most possible oil from the supply, but the environmental regulations are becoming more stringently enforced with time.

The first topic that needs to be addressed is that there is no real precise definition of what “oil in water” exactly is, making it very difficult to define a measurement. This looseness of definition is due to the fact that oil (and grease) in produced water is not a specific chemical compound that can be easily measured (Caudle (2007)). Oil in produced water can consist of droplets of crude oil, asphaltines, production treatment chemicals, and other organic compounds. Furthermore, some of this oil may be suspended, while some of it may be dissolved in the water. The relative percentages of dissolved versus suspended oil can vary enormously in different sources as well as in different parts of the extraction process. Unfortunately, no single method