

# Application Note

## Usage Guidelines for Upstream Oil & Gas Sector

Water treatment is an important aspect of oil and gas production. Without effective treatment, equipment life can be shortened, maintenance requirements can increase, and production rates can be affected. All of these considerations equate to a higher cost of operation for production wells.

Proliferation of bacteria is of chief concern in water treatment initiatives. Bacteria produce a highly toxic and corrosive gas called Hydrogen Sulfide (H<sub>2</sub>S) which can cause a souring of natural gas, crude oil and associated water. These bacteria multiply in underground reservoirs and surface lines, corroding metal pipes and lines, and sometimes causing damaging failures. They can also pose human health hazards and can limit the effectiveness of chemical treatments by degrading organic chemicals (i.e. polymers, defoamers).

During the development of oil and gas wells, bacteria can be introduced through various fluids causing corrosion, fouling, and the production of H<sub>2</sub>S. Handling equipment spreads the bacteria, resulting in even greater havoc in the oil treatment plant. Treatment of the fluids, including the mud, prevents the growth of bacteria and eliminates the risk of the dangers. The result: more effective operation, reduced costs, and a safer environment for the operators.

The first step in combating bacteria is to measure their presence. Because microbiological hazards come in a variety of shapes and sizes, the most effective first-line tool is one that measures the total population. Furthermore, because microbial proliferation is easier (and by extension, cheaper) to correct or prevent in the early stages than later on, the ideal indicator is one that provides fast feedback, preferably in real-time.

### The First Line of Defense

Enter 2<sup>nd</sup> Generation Adenosine Triphosphate (ATP) measurement technology from LuminUltra. ATP is the primary energy carrier for all forms of life and can be measured by harnessing the naturally-occurring firefly luciferase biochemical reaction. Put simply, ATP from microorganisms in a sample is reacted with a reagent that contains the firefly luciferase enzyme to produce light – more ATP produces more light, indicating more microbial activity. This measurement process is carried out using simple chemical reagents and instrumentation.

Whereas traditional methods for estimating microbes require days from sample collection to enumeration, ATP testing takes only minutes. As an additional benefit, the equipment and test kits used for ATP testing are completely portable which allows testing to be carried out on-site. This means that with one visit to a producing well, microbial problems can be assessed, corrected, and validated during a single visit. This dramatically shortens the maintenance cycle and promotes cost-effective operations.



## The LuminUltra Difference

ATP testing methods have been commonplace throughout a variety of industries for a number of years, including the food hygiene, medical, and process water treatment sectors. These 1<sup>st</sup> generation technologies are effective in that they provide a rapid estimation of total microbes and have helped to improve risk management in these sectors. However, these technologies did not meet the specific needs for oil & gas sector operators, for a number of reasons:

1. **Interferences** – Water typically associated with oil & gas production wells have Total Dissolved Solids (TDS) levels similar to or higher than that of sea water. In these types of waters, 1<sup>st</sup> generation ATP tests experience severe interference that causes underestimation of total microbes, typically by 80% or more. LuminUltra's 2<sup>nd</sup> generation products have barriers against TDS interference, as well as barrier against color, suspended solids, organics, and dead microorganisms.
2. **Reported Values** – Field technicians and operators are accustomed to communicating results on the basis of colony forming units (CFU) per mL. 1<sup>st</sup> generation ATP systems are restricted to reporting results in Relative Light Units (RLU), which does not communicate information on a similar level. Through its room-temperature stable UltraCheck 1 ATP standard, LuminUltra can convert RLU results into Microbial Equivalents, a unit identical to CFU.
3. **Fluid & Deposit Testing** – Often there is a need to test fluid samples and deposits collected from fouled or corroded equipment. Whereas 1<sup>st</sup> generation products were not optimal for testing either sample type, LuminUltra has engineered specific test kits for testing either type of sample and reporting results in minutes without the requirement for sample preparation (i.e. vortexing, sonicating). Furthermore, corrosion coupons can be analyzed directly with no intermediate preparation, and LuminUltra provides guidelines for estimating the severity of biological corrosion based on deposit and surrounding fluid analysis.

## Benefit from Rapid Information

Monitoring and controlling microbial issues in the oil and gas sector often requires multiple site visits to identify, mitigate, and validate problems. The central reason for this is that conventional microbial tests require organisms to be cultured and later counted, which take many days and are longer when temperatures are colder or bacteria grow slowly (i.e. tests for sulfate reducing bacteria can require up to 21 days). Furthermore, culture tests generally underestimate the total bacteria population and oftentimes provide ambiguous results.

LuminUltra's 2<sup>nd</sup> Generation ATP testing methodologies provide a fully quantitative number of total microorganisms in any sample type – water, oil, or deposits – and provide real-time feedback on-site regardless of the organism type or sample temperature. Elimination of the lag in feedback and reducing total test labor saves time and money for field technicians. Furthermore, obtaining fast, accurate feedback helps to guide biocide dosing programs and ensures that problems are known as quickly as possible. This ultimately eliminates delays in addressing bacteria issues and thus prevents equipment deterioration and chemical consumption.

LuminUltra's 2<sup>nd</sup> Generation ATP monitoring test kits can be used in all oil and gas production operations where culture techniques have traditionally been used, including **general water and deposit monitoring for corrosion, characterization of biofouling and pipe plugging, well fracturing operations, polymer flooding operations, seawater injection in offshore operations**, and more! Realize the benefit of real-time, complete, and quantitative microbial detection to improve your operational cost-efficiency.

