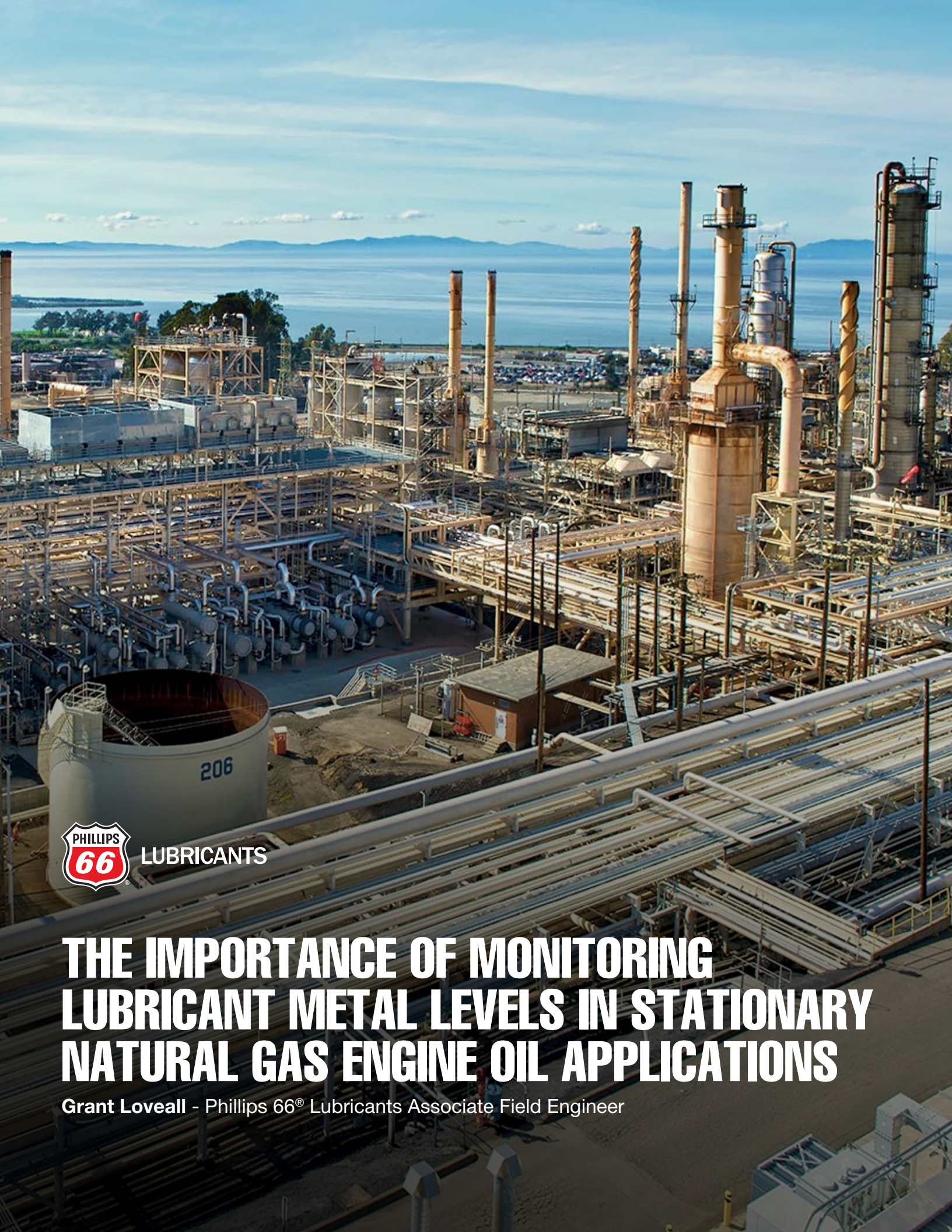

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THE IMPORTANCE OF MONITORING LUBRICANT METAL LEVELS IN STATIONARY NATURAL GAS ENGINE OIL APPLICATIONS

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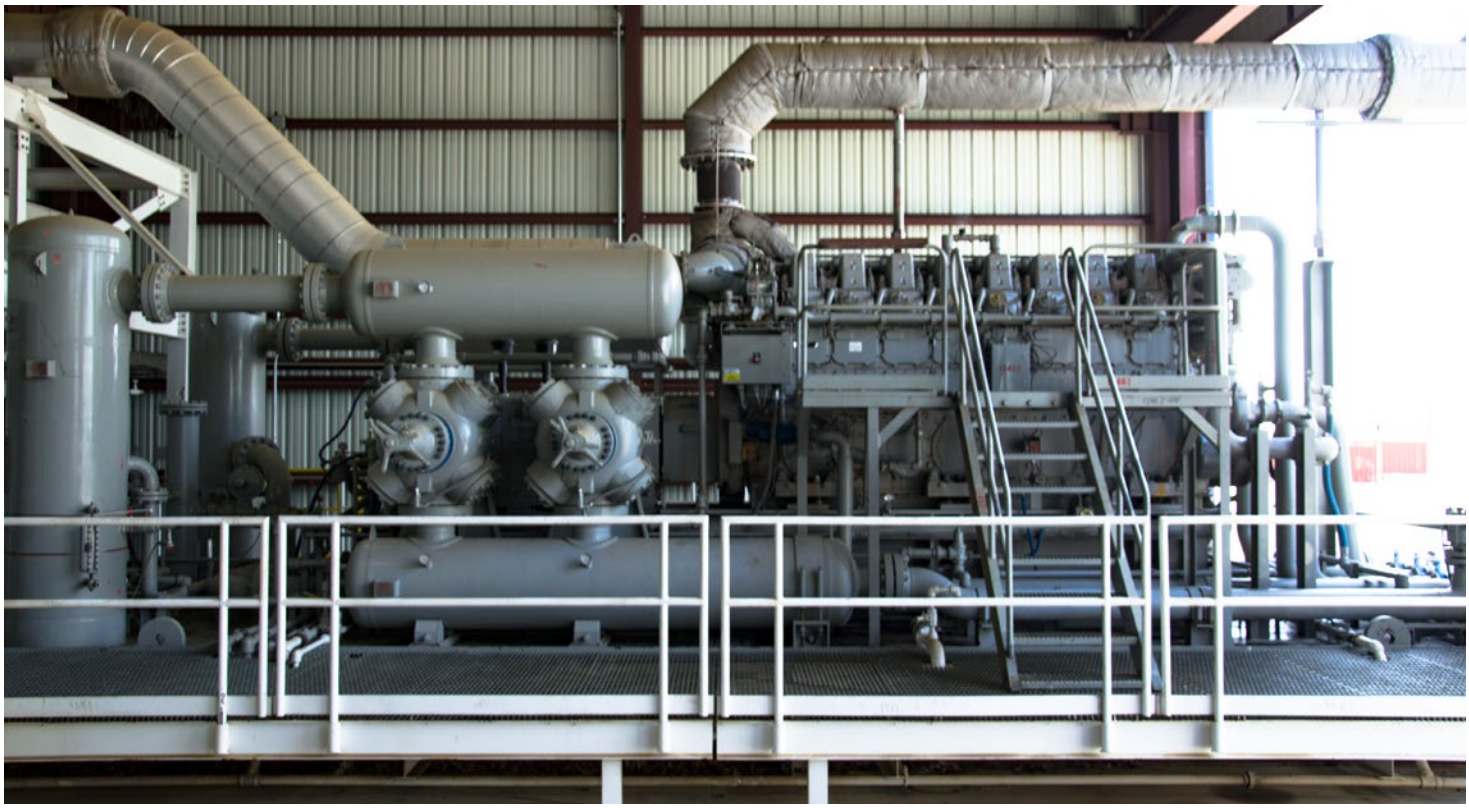
Stationary Natural Gas Engine Oils (NGEOs) are generally categorized by their levels of sulfated ash. Sulfated ash is the residue left behind after the oil is burned and consists of the metallic based additives in the oil. For NGEOs, this ash comes from calcium and magnesium-based detergents as well as zinc and phosphorus based anti-wear additives. The detergent additives help to neutralize acids generated from the combustion process whereas the anti-wear additives provide wear protection. The reason NGEOs are categorized by sulfated ash content is because natural gas engines rely on these ash deposits to cushion the valves to prevent valve recession. However, too much ash in the oil can lead to excessive buildup on the valves resulting in poor seating and eventual failure. Elevated ash levels can also lead to other combustion chamber deposits as well as deposits in aftertreatment systems.

The most common type of NGEO recommended for four-stroke stationary natural gas engines today is a low ash engine oil which will contain around 0.5 wt.% sulfated ash as measured by ASTM D 874. This level of ash is the perfect balance to cushion valves, protect the valve train, and neutralize acids but not lead to excessive deposit formation. In the natural gas industry today, many operators have switched from set oil drains based on hours in service to condition-based oil drains based on oil condition monitoring through oil analysis. This is done to reduce costs by extending oil drains. This oil analysis will normally test for viscosity, metals, acid number, and oxidation with the condemnation limits focused on wear metals (iron, copper, lead), acid number, and oxidation. While these are important to monitor, they may not provide the entire picture of the condition of the oil.

These engines can be quite large and as a result will have larger reservoirs and higher oil consumption than mobile engines, and because of this they need to be topped off consistently to maintain the oil level. This replacing of consumed oil with fresh oil replenishes the additives which helps to prevent an increase in acid number and oxidation. Unfortunately, due to combustion blow by, spent additives in the form of ash can migrate back down to the reservoir and when combined with the fresh additives being added can lead to an increase in the sulfated ash content in the system overtime. If the ash content of the oil rises too much, it can lead to excess deposits in the combustion chamber and aftertreatment system and ultimately valve failure. Monitoring the additive metal levels in the oil, particularly calcium, magnesium, zinc, and phosphorus can help give an indication that this is happening in the engine. Using this information along with wear metals, acid number, and oxidation will allow the operator to better assess drain intervals.



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