

OIL SAMPLING MISTAKES TO AVOID

Jim Fitch
Noria Corporation



Originally published in Machinery Lubrication

Machinery »
Lubrication

Oil Sampling Mistakes to Avoid



I recently received an e-mail from a colleague seeking my opinion about a specific sampling philosophy. Referring to mobile equipment such as excavators, scrapers and dozers, he asked if good oil sampling depended much on sampling location.

He wondered, as he had often heard from others, if what truly matters most is sampling consistently, regardless of location.

Sampling consistently refers to the practice of meticulously following a prescribed procedure without regard to the accuracy or precision of the procedure. This is the way most oil samples, perhaps 80 percent, are taken today.

The thought is that because oil analysis data is commonly trended, once a base line is established and samples are taken consistently, problems will be revealed in trend-line movement (change in direction, rate of change, etc.).

The fallacy with this doctrine is that it ensures only repeatability, not data quality or accuracy. This is illustrated in the figure on the left. The target on the left shows how consistent sampling and consistent analyses can be well off the mark . . . and consistently so. However, the image to the right shows the ideal combination of consistency and accuracy.

There are many ways to get useful and trendable information from oil samples taken consistently from many different locations. This is particularly true for properties of the oil that remain homogenous throughout the body of the oil such as viscosity, soluble metals (organo-metallic additives) and oxidation stability.



Much can be learned from such data, but why short-change the oil analysis program? The greatest concerns with a trending regime are false positives (nuisance alarms) and false negatives (missed alarms) that undermine the program and erode confidence when sampling practices are limited to consistency, with no regard for accuracy.

Let's take a closer look at how this occurs.

1. Bottom Sampling.

Samples consistently taken from the bottom of tanks and sumps will show higher (and unrepresentative) concentrations of bottom sediment and water as compared to system live zones. When oil physical properties, contaminants and wear metals are alarmed, it is assumed that blended overall concentrations are being measured, not concentrates in collection bowls, filters and tank bottoms.

2. Reservoir Sampling.

Samples consistently collected from the turbulent zones of tanks and reservoirs provide trendable information only on homogenous oil properties. However, wear metals and many contaminants become hidden from view by extraction or dilution.

This is because these insolubles, which are commonly ingressed or are generated at the working end of the equipment (hydraulic components, bearings, gearing, etc.), are then deposited in the large tank of cleaner fluid, or worse, removed by return-line filters in the case of many high-pressure hydraulic systems.

Even if there is no return-line filter, once wear particles, water and solid contaminants enter the reservoir, their concentration will immediately and progressively change due to dilution, settling and off-line (kidney loop) filtration.



3. Upstream Sampling.

Samples consistently taken on the feed-line of large circulating oil systems are typically the same oil with the same precision problems as the tank sample described above. This also holds true for samples taken from off-line circulating systems (filters, heat exchangers, etc.). As such, the actual concentrations of wear metals and contaminants are often lost from view. This is the easiest way to get a false negative.

4. Downstream Filter Sampling.

Occasionally an organization prefers to take samples consistently downstream of pressure-line, off-line or return-line filters. Apparently these organizations are not interested in analyzing the presence of particulate matter in the oil, such as particles the size that filters typically remove, preferring sampling convenience over sampling accuracy.

5. Dead-Zone Sampling.

Getting an oil sample from a dead zone is the same as sampling the wrong machine. Dead-zone fluids (gauge-line extensions, regenerative loops, standpipe, etc.) are stagnant and typically possess properties different from working fluids.

6. Wrong-Procedure Sampling.

There are numerous sampling procedures commonly used that are far from best practice. These include drop-tube sampling (using a vacuum pump), inadequate flushing, dirty sampling hardware/bottles, etc. Although these procedures may be used consistently, they will also consistently fail to optimize the quality and precision of the sample taken. Often these methods are used simply for convenience, in a misguided attempt to save valuable time, at the expense of valuable data and ultimately valuable equipment.



7. Cold-System Sampling.

Samples consistently collected from cold systems will have altered concentrations of wear metals, contaminants and other insoluble suspensions. When at rest, anything heavier than the oil will begin to settle. It takes only two minutes for a 20-micron particle of babbitt bearing metal to settle one-half inch in an ISO 22 bearing oil.

As you can see, consistency alone does not ensure quality sampling. And it is not possible for even the very best oil analysis lab to extract quality data from unrepresentative oil samples. The adage, garbage in, garbage out is just as true in oil analysis as it is in any other field of endeavor. Don't forget that consistency is extremely important, but only after the correct sampling location and sampling procedure have been properly identified and utilized.

When it comes to oil sampling, the goals are always to choose a location that maximizes the density of the data in the sample bottle, and to choose a procedure that minimizes the disturbance of the data. Understanding this is not a matter of intuition or raw intelligence.

It can be done only through proper instruction of the technician collecting the samples and by following documented best-practice sampling procedures.

How is your organization taking oil samples? More importantly, how much is suboptimal sampling costing your organization each year in terms of opportunity lost and misguided interpretations?





Jim Fitch



Jim Fitch is an internationally recognized authority in lubrication engineering, oil analysis, and machinery reliability, with decades of experience supporting complex industrial operations and legal matters worldwide. As the founder of Noria Corporation and a driving force behind Machinery Lubrication and Reliable Plant, Jim has helped define modern best practices in lubrication management, contamination control, and failure prevention. His work spans consulting, training, publishing, and forensic investigations for manufacturers, utilities, energy companies, and law firms seeking technically sound, defensible conclusions.

Throughout his career, Jim has served as a trusted advisor and expert witness in matters involving equipment failure, lubricant performance, contamination, maintenance practices, and operational risk. His curriculum vitae reflects extensive authorship, standards participation, laboratory and field experience, and courtroom support built on practical engineering insight rather than theory alone. Whether supporting litigation, root-cause analysis, or reliability programs, Jim brings clarity, credibility, and technical rigor to every engagement.

STAY CURRENT WITH **MACHINERY LUBRICATION**



Machinery Lubrication delivers expert-written technical content on lubrication, oil analysis, and reliability best practices — free to access.

Subscribe to receive the latest articles, case studies, and industry insights direct to your inbox.

Scan to subscribe at machinerylubrication.com

