Oil analysis is a very powerful technique in a Reliability Centered Maintenance Program. Previous articles in this publication have discussed the use of oil analysis in a condition-based program being both predictive on equipment condition and proactive on lubricant condition. Sampling is the first step—*and a key element*—in determining oil and equipment conditions. Since bad data may lead to the wrong conclusions and cause either an unnecessary or wrong action, it is critical to sample properly. As an example, let’s say you visit a physician for a blood test to determine your cholesterol level. Clearly, it is going to be very important for the doctor to get a good "representative sample" to make the correct diagnosis. One hour before the exam, however, you eat a double cheeseburger with fries. In all likelihood, your results will come back positive for high cholesterol and the doctor may put you on medication and a strict dietary program. If you’ve not had problems in the past, the correct course of action would be to take another sample. If it is a good representative sample and comes back positive, you can rest assured that your doctor took the right course of action from the outset. On the other hand, if the second blood test comes back negative, there is a possibility that the first sample was not truly "representative"—
*and that your doctor took the wrong course of action.*
Our cholesterol test example is very similar to what can happen with oil analysis. If a sample is not taken properly, it may lead to the wrong conclusions. Therefore, you never shut down a piece of equipment based on the results of just one sample. You should always resample when unusual results come back on an oil analysis report.

**The main objectives of a sampling program are to:**

- maximize data concentration;

- minimize outside interferences;
- sample at proper intervals.

**Important considerations in an effective sampling program are:**

- sampling location
- sampling hardware
- sample bottles
- sample procedure

**Oil analysis provides the following basic information:**

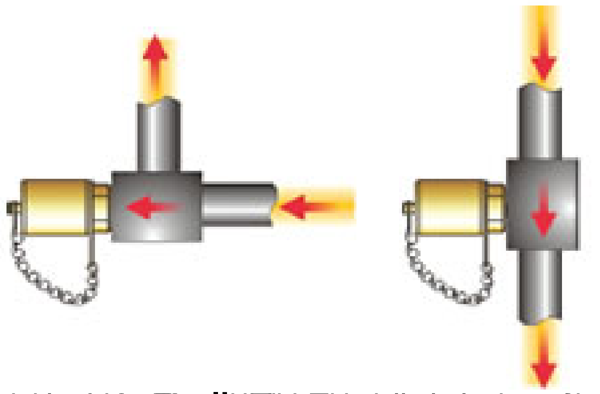
- oil condition
- equipment condition
- contaminant type and amount

**Table I. Summary of Oil Analysis Testing & Information Provided**

| OBJECTIVE | OIL ANALYSIS TESTS | INFORMATION PROVIDED |
| --- | --- | --- |
| Oil Condition | Viscosity<br>Emission Spectroscopy<br>Acid Number<br>FTIR | Oxidation/thermal degradation<br>Additive depletion<br>Oxidation<br>Nitration/oxidation |
| Equipment Condition | Emission Spectroscopy<br>Direct Read Ferrorapy | Initial wear<br>Ferrous wear large and small particles |
| | Analytical Ferrorapy | Particle morphology indicating wear type and location. This is the only technique justifying equipment shutdown. |
| | Particle Count | Possible wear debris |
| Contamination | Karl Fischer | Water content |
| | Particle Count | Solid contaminants |
| | Fuel Dilution | Fuel in engine oil |
| | Soot | Soot in engine oil |
| | Viscosity | Contamination with higher or lighter viscosity component |
| | Emission Spectroscopy | Silicon from dirt and coolant leak in engine oil |

[illegible]

**Fig. 1. Preferred live zone sampling done at an elbow or T for good mixing** (*courtesy of Slater Trico*)



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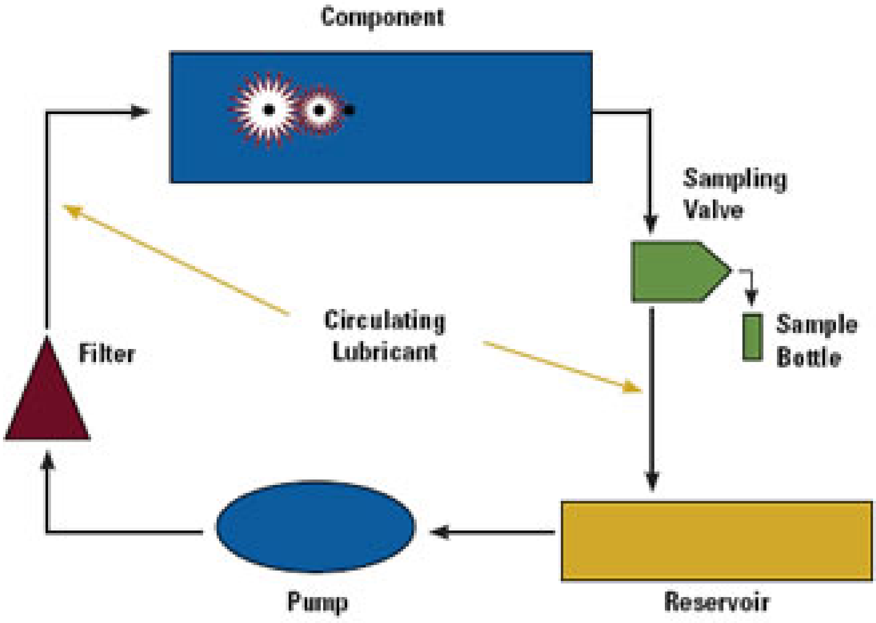


Fig. 2. Primary sampling location within return line of a circulating system (*courtesy of Dalley Predict*)

[illegible]

Fig. 3. The most common static system sampling technique via a vacuum gun with plastic tubing

[illegible]

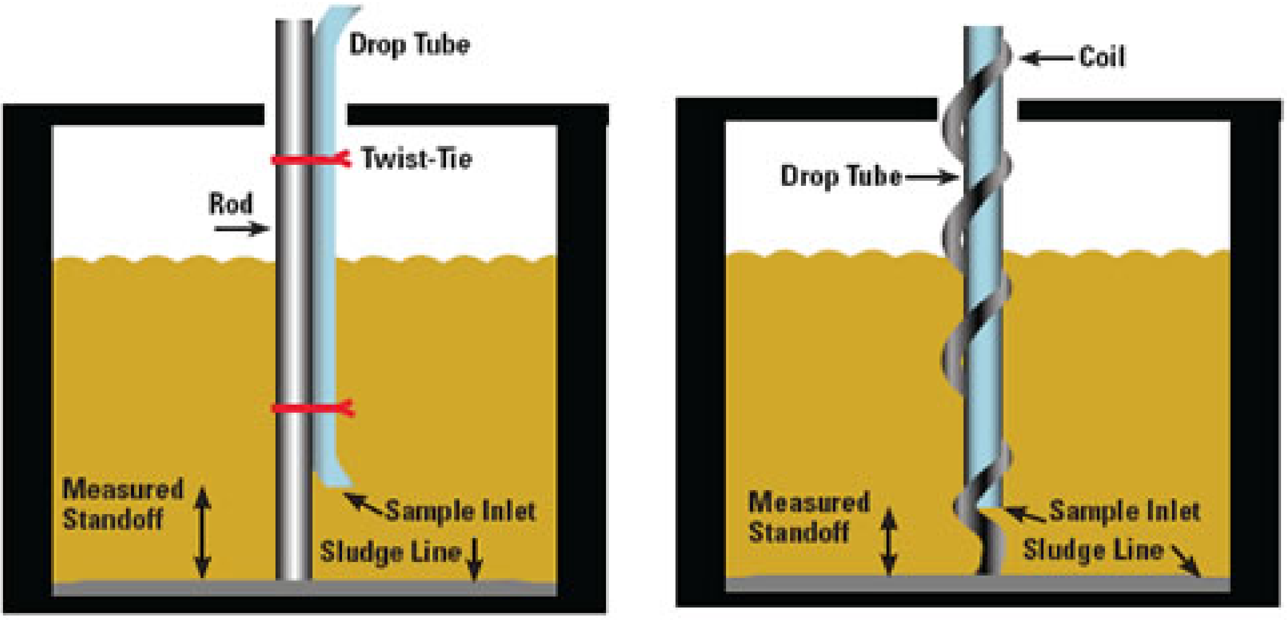


Fig. 4. Plastic collecting tube wrapped around steel rods helps ensure consistent reservoir sampling

[illegible]

Table II. Sampling Frequency Guidelines

| MACHINE TYPE | NORMAL USE | INTERMITTENT USE |
|---|---|---|
| Diesel Engines | Monthly, 500 Hrs | Quarterly |
| Natural Gas Engines | Monthly, 500 Hrs | Quarterly |
| Gas Turbines | Monthly, 500 Hrs | Quarterly |
| Steam Turbines | Bi-monthly, Monthly | Quarterly |
| Air, Gas Compressors | Monthly, 500 Hrs | Quarterly |
| Refrigeration Compressors | Start, Mid & End of Season | Start, Mid & End of Season |
| Gears, Bearings | Bi-monthly, Monthly | Quarterly |
| Hydraulics | Bi-monthly, Monthly | Quarterly |

[illegible]

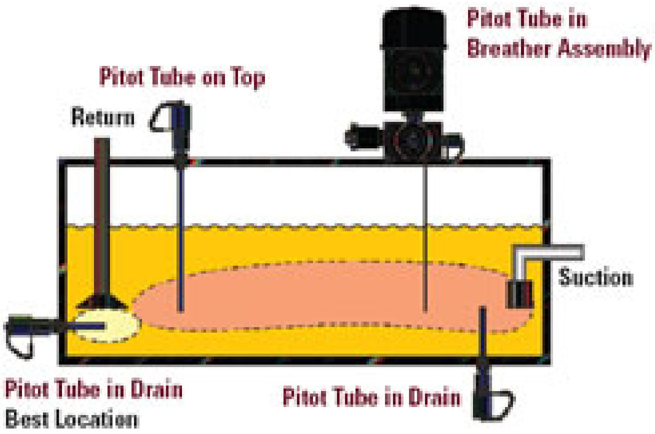


Fig 5. Better reservoir sampling technique incorporating a sample tube (*courtesy Slater Trico*)