WEAR CHECK
Condition Monitoring Specialists

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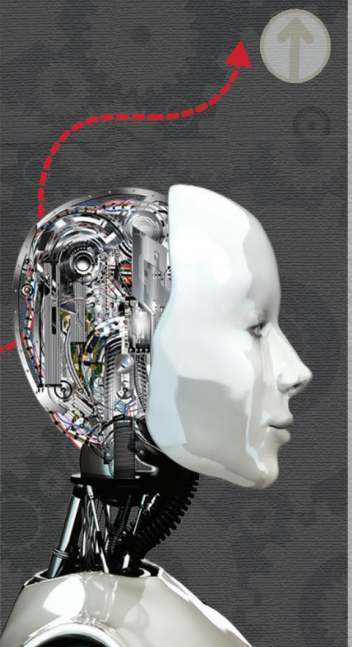
Oil Analysis: corrective action - the investment that pays a cost-savings dividend!

by Shesby Chabaya – head: operations, WearCheck Zimbabwe

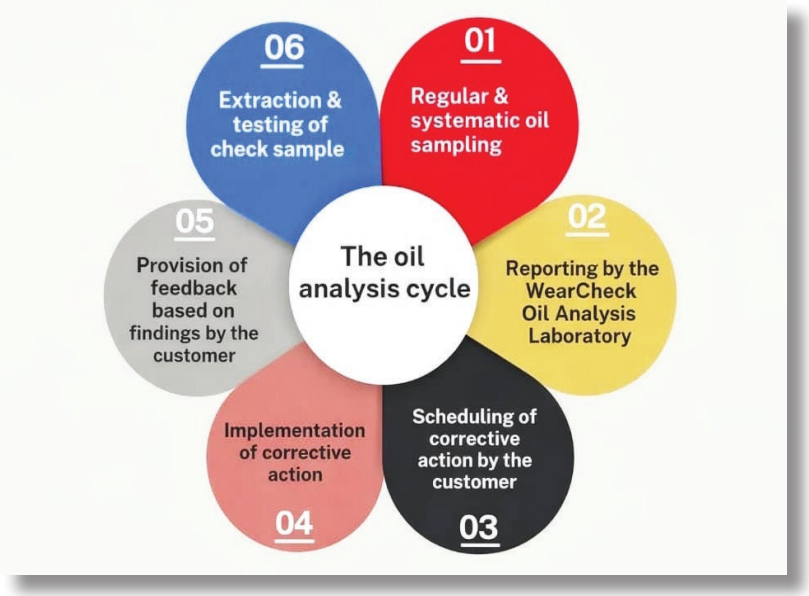
The majority of organisations implementing oil analysis face the challenge of maximising operational cost savings against the pressure to achieve full production and enhancing shareholder value. Oil analysis provides a means to achieve the end goal – a positive payback and overall cost savings. However this is not a given - an organisation may or may not achieve the intended benefits for several reasons, chief among them being failure to implement a sound corrective-action strategy.

This *Technical Bulletin* aims to investigate the reasons behind organisations' inability to attain cost savings and also to provide information on how to optimise operational cost savings by being responsive to the outcomes on analysis reports, or by taking remedial action. I will discuss the benefits and drawbacks of taking remedial action, or not doing so, the Key Performance Indicators (KPIs) for tracking progress, as well as "What cost savings look like" and "What cost savings are not," using data analysis outcomes and case studies.



In order to achieve financial savings, organisations must implement systems that facilitate the effective operation of the oil analysis programme and conduct periodic audits to ensure that the processes are being followed.

It all begins with regular and systematic oil sampling that generates data on an on-going basis to enhance informed decision-making. The oil analysis or cost-savings cycle is iterative and can be detailed as follows:



As illustrated in the diagram above, when oil sampling is done on a regular and systematic basis, problems are identified and reported by the laboratory, equipment is scheduled for troubleshooting and investigation, then corrective action that addresses the root cause of the problem is implemented, guided by the response time indicated by the laboratory. This results in performance improvement and cost savings. A check sample is taken to confirm improvement, and the process keeps repeating as machine operating hours increase.

It is important to mention that, very often, corrective action is taken but the problem persists. The key is in addressing the root cause of the identified problem. The following KPIs can be utilised to track the effectiveness of corrective action taken or lack thereof:

	KPI DESCRIPTION	TARGET
1. Fault Repeats	Tracking repeat problems	"Thou shalt not allow a problem to appear more than twice consecutvely".
2. Scheduled / unscheduled work.	Ratio of scheduled to unscheduled work.	3:1 or better.
3. % Feedback	Percentage feedback level following corrective action taken.	Target 100%.
4. Response Time	Feedback Days - Number of days taken to submit Feedback.	<30 Days.
5. Improved Cases	Number of improved cases per month following actions taken.	This is a major cost savings indicator. Target - 100%, **convert all alarms*** into cost savings.

**An alarm is a report expressing the need for corrective action. It is characterised by an urgent or critical report severity, a call to action in response to a problem identified and reported by the oil test laboratory, WearCheck.*

THE BIG PICTURE PRINCIPLE

It is not enough to focus on reacting to the individual oil sample result, even though this contributes immensely to overall cost savings. The big picture principle must be applied on an on-going basis, where the maintenance engineer or manager applies a strategic approach. This entails examining the overall context, trending results month by month, year by year and looking at long-term outcomes and indicators, prioritising critical issues and focusing on solutions to identify fleet or plant problems, adaptability and sustainability.

Some of the key questions are:

- Is this problem affecting this component only or the entire fleet or plant?
- Is it affecting a specific make & model of plant?
- Is it affecting how a plant operates in a specific operating environment?
- Is it affected by changes in load or intensity of operation?
- Is it affecting equipment operated by a specific operator?
- Are our operational systems adaptable enough or responsive to current needs or indicators?

WearCheck can assist customers in managing and optimising their oil analysis programmes through comprehensive KPI reports that distil key data such as severity trends, repeat problems, component or fleet-level problem patterns and data-quality issues into clear, actionable insights that assist with reliability improvement and root cause analysis. These tailored reports form part of WearCheck's management-support offering and are available as an optional service upon request.

WHAT COST SAVINGS ARE NOT!

In a recent study, we examined a year's worth of oil analysis data across all components on a mobile plant from engines, transmissions, hydraulic systems and axles for a company within the manufacturing industry. The findings were as follows:

- 46% of the annual oil samples extracted were alarms (Ratio almost 1:2).
- 28% of the total annual problems or alarms are repeat issues.
- 1 in every 3 alarms represented a repeat problem.

Interpretation: one in every two oil sample results is an alarm and the total alarms figure is 27% above the set target for the year. The percentage of repeat problems is significant, meaning repeat problems are the key driver of the accumulated annual alarms/overall problematic oil samples. These figures are exorbitant and the scenario can be described as too costly and un-economical.

A repeat problem is a pointer to a slow response-rate to alarms, or that the corrective action implemented did not address the root cause of the problem. Alternatively, it is simply indicative of the absence of corrective action. We decided to test this assertion further by examining the level of feedback, and findings were as follows:

- Percentage feedback for the year was 28%.
- Average feedback days for cases where feedback was submitted: 186 days, some of the reports needing feedback were running into day 300 without any response.

Interpretation: only 28% of alarms had feedback submitted and it took 186 days to submit the feedback, with some cases going into 300 days with no feedback, indicating a poor responsiveness to alarms.

Given the findings above, it can be argued that with a feedback level of 28%, a greater percentage of alarms went unresolved, resulting in fault repeats and lost potential cost savings. Identified problems continued to recur, exposing the fleet to the risk of catastrophic failure - a situation which would negatively impact productivity. This is indicative of a "Snowball Effect".

THE SNOWBALL EFFECT

A snowball rolling down a slope will pick up more snow on its way, thereby growing bigger in size and gaining more momentum, to the point that one may not even be able to stop it. By the same token, a regular study of oil analysis data over two decades has revealed that small, identified problems - if not resolved early - will grow into much larger and more complex challenges over time. The identified problem keeps repeating and getting worse, in most cases to the point of component failure. Therefore, we have seen that the longer one waits or procrastinates addressing a problem, the higher the likelihood that it may not even be addressed, exposing plant to the risk of component failure, expensive repair costs and lost production.

Is there any correlation between low feedback, fault repeats and component changes?

In the study, we raised further questions to determine if there was a correlation between low feedback levels, fault repeats, component failures, and component changes, among other factors. We discovered that there was a link between component changes of oil-wetted components and oil analysis fault repeats. The components that were being repaired had a history of repeated contamination and wear problems.

"Thou shalt not allow a problem to recur more than twice"!

There was also a common pattern noticeable with the third consecutive occurrence of a fault (three counts of a fault repeat). Three out of four components with fault repeats either went through a parts change on the third consecutive occurrence or a complete component change. This was the case in areas of high intensity of operation. In areas of low intensity of operation, repeated parts changes were a common phenomenon. Below is a trend for Fleet D01 Transmission showing movement from "Normal" severity status to "Borderline" in month three, then further deterioration in months four and five, with resultant component failure three months after the water-contamination problem was discovered:

	Month	1	2	3	4	5	7	
Fleet / Component	D01 Transmission	Normal	Normal	Borderline - Water	Urgent - Water & Wear	Critical - Water & Wear	Component failure reported.	Result Description

Trend of samples for Fleet D01 Transmission

This is true to the key phrase "Oil analysis helps the most if you pick up a problem and address it at its onset." We also noticed that this phenomenon of excessive fault repeats was synonymous with over-expenditure. The phrase "We have overshot our budget" was common during feedback sessions. Components end up running to failure, reminiscent of the "Black Swan Effect" (when unpredictable events are explained in hindsight), with severe consequences - to the extent of affecting a whole production line when a catastrophic breakdown occurs.

Looking at the case of new equipment with purchase cost exceeding US$500 000 and, in some cases, running above US$1 Million depending on machine type, brand, size, application and other factors, we realised that by the time it reaches year five, it has undergone substantial component changes - a situation which increases the average cost of equipment ownership. The equipment is not able to achieve its full expected life.

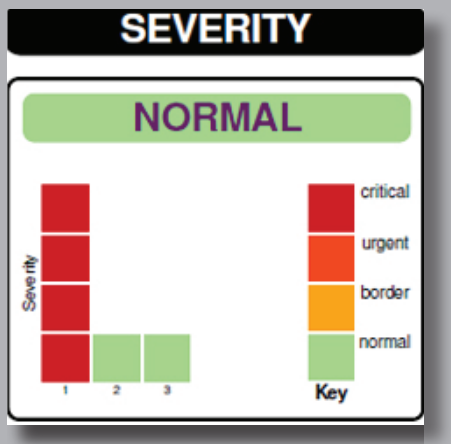
Undoubtedly, the above scenario provides a compelling case for every organisation that has decided to embark on an oil analysis programme to put in place and relentlessly enforce systems that enhance effectiveness and efficiency, guided by the vision to achieve cost savings. Poor responsiveness to oil analysis reports creates a huge opportunity cost, as every alarm presents an opportunity to save. It therefore follows that, if an organisation is to reap the benefits of investing in an oil analysis programme, a sound corrective-action strategy must be at the heart of the maintenance system.

WHAT COST SAVINGS ARE!

To demonstrate what cost savings are, we will examine a case study from Delta Transport Services, the Transport and Logistics arm of Delta Corporation Limited, a leading beverage-manufacturing company in Southern Africa that has been implementing the oil analysis programme for the past twenty-five years:

Forklift Differential Case:

A scheduled oil sample was extracted from a Forklift Differential (sample 1). The WearCheck laboratory detected and urgently reported critical water contamination at 4.1%. The workshop responded quickly, which allowed the defective breather to be changed. The results of the two subsequent oil tests showed that the issue had vanished, indicating that the problem's underlying cause had been identified and fixed. The diagram below illustrates the improvement in report-severity status:



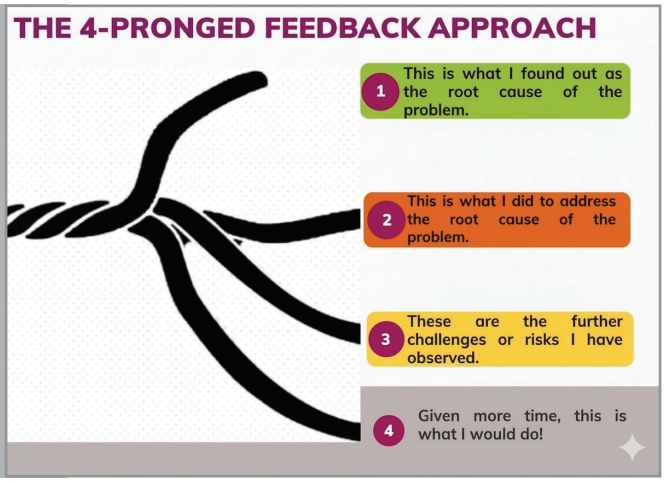
Sample 1 showed critical status (Red), 4.1% water detected – immediate attention to problem required! Following a swift response by the workshop team, the problem was addressed, resulting in improvement of report-severity status to normal status (Green) for the next two scheduled oil samples.

If the issue hadn't been resolved in a timely manner, the organisation might have suffered a premature differential failure that would have cost it anywhere from US$2,500 to US$9,000 in repairs or component-replacement expenses, not to mention the expense of missed productivity and downtime – imagine if this had been a CAT 797, this could have saved US$100,000 cost of differential overhaul. Therefore, good responsiveness by the team significantly reduced the risk of failure, thus improving forklift availability and reliability. This approach has been utilised across the entire fleet at Delta Transport Services over time, bringing about a multiplier effect, which has resulted in huge cost savings and forklifts attaining between 18 and 21 operational hours per day.

Delta Transport Services Technical Manager, Mr Tavonga Gwatidzo, had this to say:
'Well done to the team for upholding systems and maintaining a good level of responsiveness to the alerts by WearCheck. The WearCheck tribology programme has assisted Delta Transport to maintain a reliable, healthy and highly productive fleet. We have managed to achieve up to 30 000 forklift operational hours against a target of 18 000 hours. We believe that effective implementation of the oil analysis and condition monitoring programme is contributing significantly to this level of success. Thank you to Team WearCheck for the partnership.'

Kennedy Kashangura, Delta Transport Services National Operations Executive added:
'Our two key KPIs - oil sampling compliance and corrective action response rate - help us to maximise operational cost savings and keep productivity high. The WearCheck oil analysis programme keeps us ahead of the pack. With an average fleet availability of 98.8%, we are able to move our products on time, ensuring good customer satisfaction. Our systems are standardised throughout all our operations around the country, with WearCheck at the heart of our maintenance systems.'

In reality: time, resources and production pressure are always a constraint. From WearCheck's perspective, feedback is critical - in order to ensure full team participation in the continuous improvement process and boost cost savings, we encourage the implementation of a four-pronged actions-and-feedback approach as follows:



Gaining maximum return on investment into a good condition monitoring programme requires leadership with a strong business culture cultivating a positive work ethic and a winning mentality across the team, leading to an ultimate positive cost-savings yield.

Oil analysis is not an event; it is a process involving an accumulation of many tiny actions, which can result in a Domino Effect – where one event triggers a chain of related events. Just as knocking down a single domino can lead to a chain reaction where the rest of the Dominos fall, small and consistent corrective actions in oil analysis will lead to enormous outcomes, encompassing huge cost savings and attainment of full productivity through full utilisation of assets. These wins are noticeable through individual improvements which are cumulative over time.

ABOUT THE AUTHOR

Shesby Chabaya, Head of Operations at WearCheck Zimbabwe, has over two decades of condition monitoring experience supporting mining and other industries across Zimbabwe and the wider African region. Since joining WearCheck Zimbabwe (formerly Tribology Services) in 2003, Shesby has trained hundreds of engineers and artisans while maintaining key corporate stakeholder relationships. He holds certifications in tribology and lubrication engineering, oil, fuel and transformer oil analysis, as well as a marketing management degree and an Executive MBA; has authored multiple case studies (including award-winning work recognised by the South African Institute of Tribology); and is a fellow and past Chairman of the KAAD Association of Scholars in Southern Africa, and a member of the South African Institute of Tribology and the Zimbabwe Institution of Engineers.

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Head Office KwaZulu-Natal
No. 4 The Terrace,
Westway Office Park,
Westville, KZN, 3629
PO Box 15108,
Westmead, KZN, 3608
t +27 31 700 5460
e marketing@wearcheck.co.za
w www.wearcheck.co.za

Gauteng Office
55 Angus Crescent,
Longmeadow Business
Estate ext. 1, JHB 1609
t +27 11 392 6322
e marketing@wearcheck.co.za

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