# CONDITION MONITORING INTEGRATION

**(Process Strategy beyond 21ˢᵗ Century)**
**(Part 2)**

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## RELIABILITY CENTRED MAINTENANCE

*Reliability Centred Maintenance (RCM) is the probability that equipment will survive a definite operating period under specified operating conditions, and without failure. Therefore, the life of a component has little meaning unless a probability of survival is associated with it. This type of maintenance approach concentrates on maintaining the reliability of equipment through rationalized scheduled maintenance.*



The RCM Process
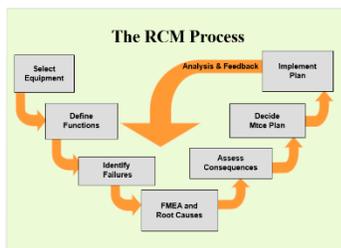
Maintenance activities are determined based on the goal of having each piece of equipment operating in the most reliable manner possible at the lowest cost. Proactive approaches, such as *predictive maintenance* have been traditionally reserved for components with significant consequences of failure due to their high cost. However, the paradigm has been shifting with the introduction of OEM monitoring systems as standard equipment on virtually all major mining equipment.

## CONDITION MONITORING STRATEGY

Condition monitoring is built on the fact that most failures will give some type of warning that they are going to occur (potential failure). It is the physical indication that a functional failure (equipment cannot meet its specified performance standard) is in the process of occurring. Condition monitoring techniques can obtain precise evidence that a failure is occurring. Condition-based maintenance carefully monitors actual, current equipment condition. It is always less costly and more effective than fixed-interval component replacements and overhauls throughout the life-cycle of equipment. Condition-based maintenance can improve the way equipment is operated and maintained rather than try to redesign it. Redesign should only be attempted if better operation and maintenance will not deliver improvement in the equipment performance.

Time-based overhaul maintenance philosophy pays less attention to how components fail and the consequences of failure. There is an assumption that components "wear out" and become less reliable as operating age increases. Thus, mining maintenance has tried to restore equipment to an "as new" by periodically replacing component or overhauling the unit. In doing so, maintenance has overlooked the failure process itself and the question of what constitutes a failure. This omission has led maintenance process of avoiding downtime and production loss rather than one based on a wider range of consequences should equipment fail. This explains why there is much emphasis on meeting production targets and so little attention on maintenance. Thus, reliability-centred maintenance reminds us that these consequences affect everything from reliability to profitability and they demand more attention than they were getting.

Traditional predictive maintenance technologies at the disposal of most maintenance organization include; *ultrasonic testing, vibration analysis, oil analysis, etc*. Inspection based on these technologies most often require, as a necessity to shut down the equipment or remove it from active production. Therefore, the costs of these inspections in terms of loss of availability and production loss can be high. *Maintenance planners must balance the cost of inspections against the probability of failure, failure mode and consequences of failure in order to determine the appropriate inspection interval for each subsystem or component. The logistics of this manual method of collecting data typically limit data collection to scheduled maintenance events (Lewis, 2001).*

On-board monitoring systems have the ability of continuously monitor numerous vital parameters. Typically, when an anomalous condition is detected by the monitoring system, the operator is notified by an audible alarm, warning light, textual display, or graphical display. The operator may respond by either ignoring

the alarm or stopping the equipment for maintenance personnel to carry out a diagnostic process, and if identified to be critical, appropriate steps are taken to fix the problem. Some critical events are often ignored by operators which trigger unnecessary and avoidable downtime and production losses.

(End Part 2 – to be continued)