

The Role of Defect Elimination in Reducing Hazard Exposure

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In early 2008, Anglo Coal Australia identified eight improvement areas for the business to focus on in order to extract extra value from its assets. One of these initiatives was to focus on improving equipment performance through improved maintenance practises & processes. Seven key improvement projects were identified by a team of maintenance leaders from corporate and site levels. One of the seven projects was to implement a defect elimination process at each site. What wasn't understood at the time was the impact defect elimination would have on reducing the hazard exposure rates on front line employees. This paper summarises the defect elimination process developed at Anglo and draws the link between hazard exposure rates.

Defect elimination is a well known and recognised process across many industries. The aim of this process is to simply identify recurring type failure and eliminate them. Each Anglo site engaged a reliability engineer to analyse delay, workorder and cost data to identify potential improvement areas. For example, at one of the open cut mines, the large capacity truck fleet was selected. The availability on this fleet had deteriorated over a number of years therefore it was selected to trial the defect elimination process. The diagram below shows the fleet availability deteriorating over time.

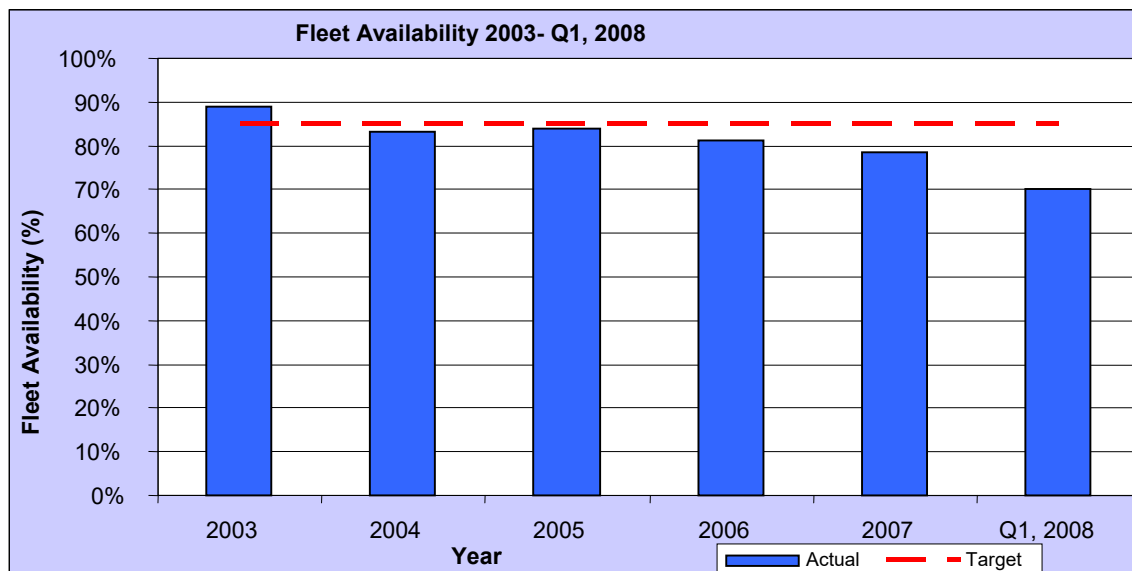


Diagram 1 shows the truck fleet availability.

From a safety perspective, each time a truck failed, a fitter or electrician was exposed to potential hazards involved with performing work. The main drivers of downtime were then identified so that further detailed investigation could occur (refer diagram 2 below).

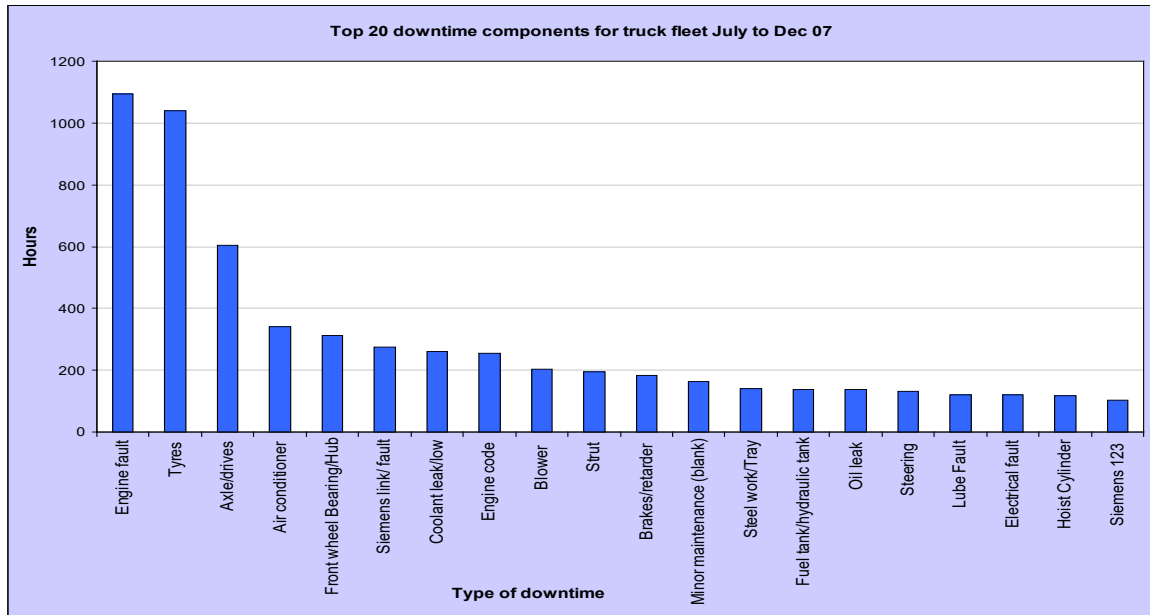


Diagram 2 shows the main drivers of downtime.

The total number of defect events over a 12 month period for the trucks was 2831. Each job on average was estimated as having 5 key hazards (such as energy sources, traffic interaction, accessing heights, manual handling and hot work) that could potentially harm. This means our team members have to make at least 14155 correct hazard identification and control choices to prevent themselves being hurt on the large truck fleet each year. Our employees have the training and tools to identify and manage these hazards however it only takes a small distraction or oversight to miss a hazard and potentially end up hurt.

The following diagram shows the correlation between the availability (which is directly related to the number of breakdown events) and the number of injuries in the maintenance department. Through the duration of the defect removal project, the availability increased (which indicates the numbers of failures reduced) and the number of maintenance injuries decreased. After the project had finished the availability has decreased slightly and the injuries have increased again. In conjunction with the defect elimination project was a defect backlog reduction project which was managed with extra labour in a planned workshop environment. These two initiatives together lead to higher availability and less field breakdown callouts hence less hazard exposure.

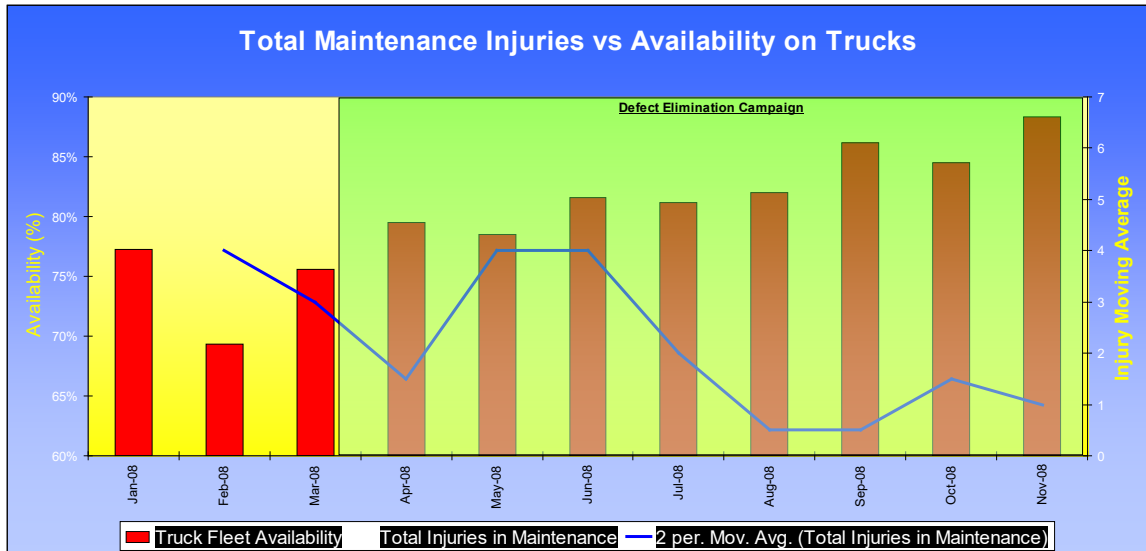
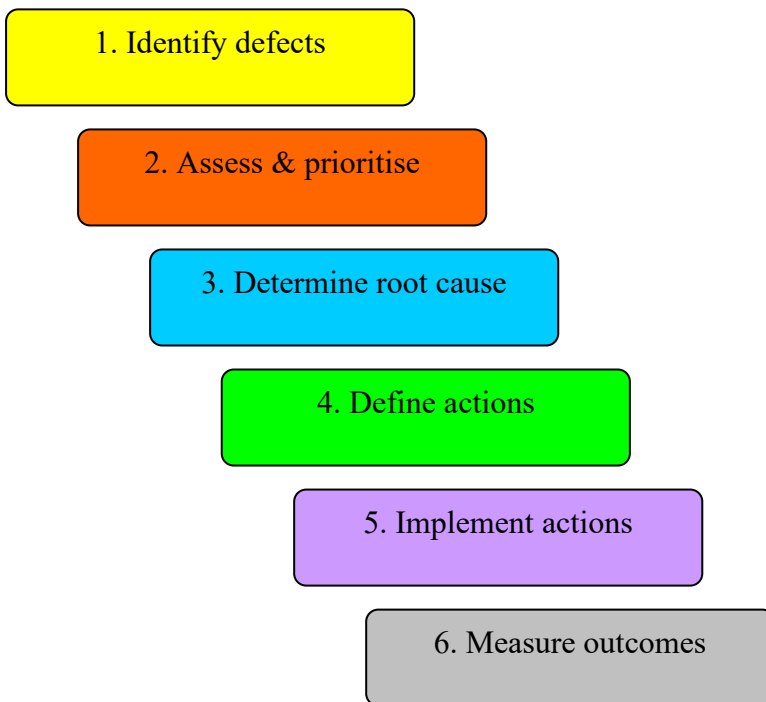


Diagram 3 shows the truck availability along with the number of injuries (LTI + MTC + FAC) by month for the duration of the project.

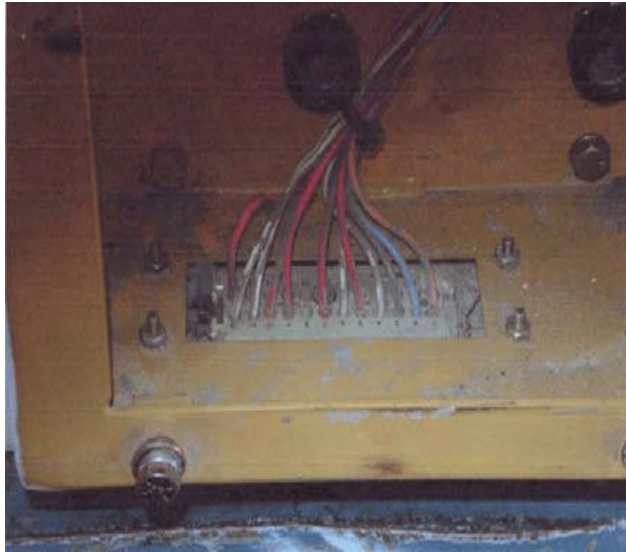
The defect elimination process used at Anglo has 6 key steps:



The following pages describe some of the projects that have been completed to date.

Truck 5XH main alternator plug defect elimination

Before



Problem

Ground faults from dirt and water ingress into plug connections

Root Cause

Poor plug location.

After



What benefit will be seen?

Reduction in downtime related to engine speed faults, alternator over-temperatures and open circuits. **Reduced hazard exposure to rectify faults in the field.**

Production Impact

34 hours less downtime per year

Solution

Remove the 5XH plug and hard wire the cables directly into the alternator terminations.

Plug replaced with gland and cover plate hence eliminating the potential for dust and water contamination.

Truck final drives and hydraulics – life extension

Final drives oil filtration



Problem

Final drives failing prematurely.

Root Cause

Contamination from wearing internal components due to inadequate viscosity oil.

What benefit will be seen?

Reduced gear and bearing wear in the final drives and hydraulic systems. This will allow us to maximise the life of the final drives to achieve >30000 hours. OEM recommends replacement at 20000 hours. **Reduced hazard exposure due to less frequent maintenance required.**

Analysing the samples

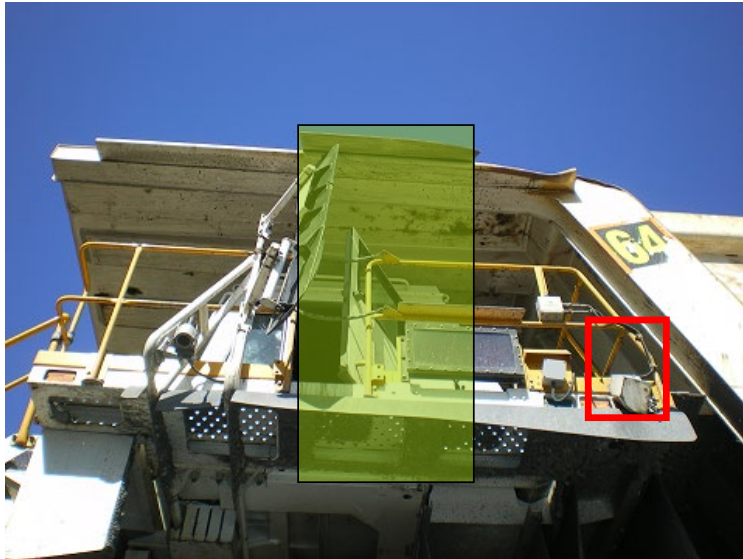


Solution

Change oil type to Hyperia S680 synthetic lube from Shell Spirax 85W-140. Implement kidney filtration looping on final drives and hydraulic tanks at services to maintain new oil and reduce contamination and component wear.

Truck reverse light damage – defect elimination

Before



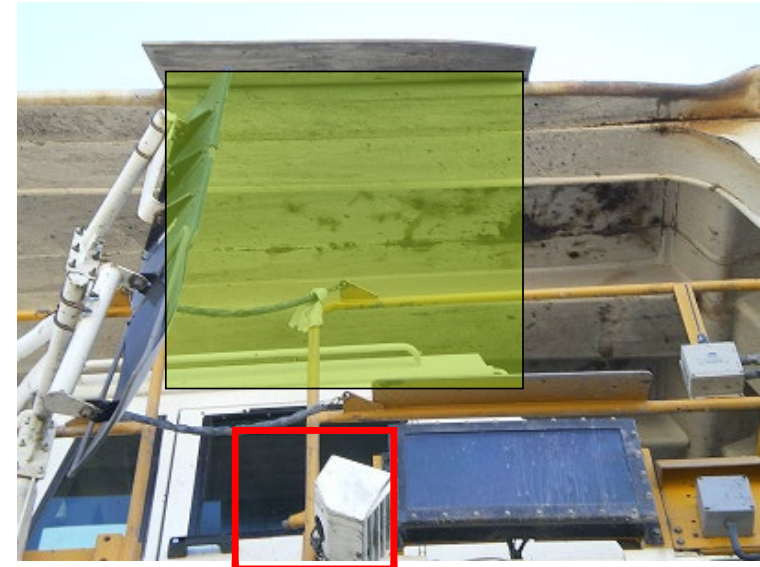
Problem

Light damage caused by falling rocks

Root Cause

Location of light not protected from falling rocks

After



What benefit will be seen?

49 recorded work orders in the last 12 months were raised to rectify damaged lights. A conservative average for the downtime and labour would be 1 hours per event plus new lights 50% of time. **Reduced hazard exposure by eliminating the need to rectify the defect.**

Production Impact

49 hours less downtime per year

Solution

Relocate the light next to the mirror. The mirror is located under a steel protection wing on the top of the tray. This wing should protect the light.

Summary

The benefits of the defect removal and elimination program have been:

- Reduced the number of times tradespeople need to attend a recurring problem on the large truck fleet.
- Reduced overall hazard exposure to large truck fleet.
- Reduction in exposure rates reduces the likelihood variable hence risk level reduces.
- Reduction in direct maintenance costs.
- Increased asset performance.
- Change of maintenance culture from fixers to proactive defect eliminators.
- Great teamwork and energy levels to find solutions to problems. Technical workers enjoy finding solutions to problems.

The defect elimination program has focused on the smaller recurring type faults that are easy to find and implement solutions. The solutions are generally within the control of the work teams to implement hence have seen good buy in from all involved. Each work team has selected a number of problems to find solutions for, in conjunction with the reliability engineer.

Defect elimination has potential to influence both safety and operational performance of any business and should be considered as an essential part of any improvement plan.