Significant Incident Report No. 254

Subject: Uncontrolled release of energy during removal of luffing cylinder pin

Date: 06 July 2017

Summary of incident

In October 2016, specialist contractors were attempting to remove a trunnion pin from a reclaimer's luffing cylinder using a purpose-built, hydraulically powered extraction implement.

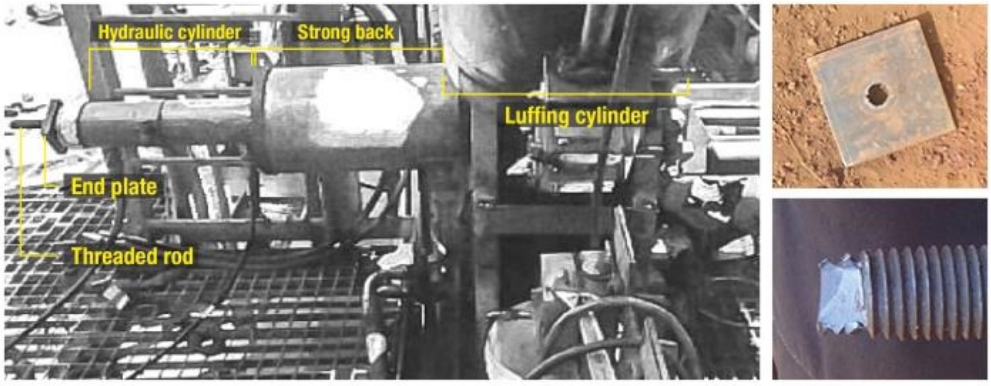
Note: The extraction implement consisted of a hydraulic cylinder that pulled on an end plate, which in turn pulled on the reclaimer's trunnion pin via a threaded rod.

Removing the trunnion pin was difficult and there were several attempts to extract the pin. On each attempt the pulling action of the extraction implement was increased.

Note: The maximum pressure applied was reported to be 90 per cent of the hydraulic system's capacity.

After the fifth attempt the threaded rod failed unexpectedly, releasing stored energy. The rod and end plate were ejected from the work area (on an elevated maintenance platform of the reclaimer). The end plate missed an operating crane and was found about 20 metres away on the ground.

Further investigation identified that the threaded rod had failed due to tensile overstress.



Left. Picture from the specialist contractor's safe work procedure illustrating the set-up of the implement.
Right. Ejected end plate (top) and failed threaded rod (below).

Direct causes

- The load applied by the hydraulic system exceeded the tensile capacity of the threaded rod.

Contributory causes

- No safe operating limits were specified in the safe work procedure or job hazard assessment.

- There was inadequate safety-in-design consideration for the implement as the hydraulic system was capable of exceeding the breaking capacity of the threaded rod.
- Engineered protection devices (e.g. pressure relief device) were not designed or installed correctly to protect the system from inadvertent overloading.
- The controls for the safe use of the implement were not identified as inadequate in the risk assessment process.

  Note: The specialist contractor had previously carried out similar tasks using similar equipment for the mining operation.

- The threaded rod was not adequately rated or assessed by a competent person.

  Note: No detail drawings could be provided at the time of the investigation. Also, the site's supervisory team assessment of the capacity of the threaded rod was incorrect.

Actions required

- Use competent person(s) to design and load rate all purpose-built mechanical tools or implements.
- Consider using engineering controls to mitigate the risk of overloading of mechanical systems (e.g. load limiting devices such as pressure control valves).
- Identify and document the operating limit or capacity of the purpose-built mechanical tool, in a safe work or operating procedure.

  Note: The operating limit should be based on the published capacity of the components of the tool, determined using sound engineering principles, or have its upper limit tested in a safe environment.

- Consult the original equipment manufacturer (OEM) of the plant when developing special tools and work procedures to perform maintenance on that plant.
- If the tool's procedure does not work as intended, communicate with the OEM of the plant, or supplier of the purpose-built mechanical tool.
- Adequately train, and verify as competent, personnel using specialised tooling.

Further information

- Department of Mines and Petroleum, Mining safety publications, www.dmp.wa.gov.au/Safety/Mining-Safety-publications-16162.aspx

  Significant Incident Report No. 208 *Bystander struck by component ejected from accumulator*

  Significant Incident Report No. 169 *Suspension component ejected under high pressure during maintenance – fatal accident*

This Significant Incident Report was approved for release by the State Mining Engineer on 06 July 2017