ISC Safety Lore
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Key Lessons on the importance of guarding rotating equipment

Introduction

Rotating equipment comprises machinery with components designed to rotate around an axis. This is essential in industries like oil and gas, power generation and manufacturing. Examples of rotating equipment in these industries include pumps, compressors, turbines and motors. The equipment mentioned play a critical role in liquid transfer, gas compression, power generation and various manufacturing processes, often in industries we may take for granted due to not being major accident hazard sites. Maintenance and safety measures are crucial to ensure their efficient operation and reliability across diverse industrial applications and guarding the rotating axis is key to protecting people.

Case 1 – No Protection on Wind Turbine Rotating Shaft

On 16 September 2009 a 27 year old technician employed by a wind turbine operating company was killed. The technician was part of a group that included one other representative from the same operating company and two engineers from a contracting company inspecting a turbine at windfarm in Scotland. The technician, who was the senior technician for the inspection came into contact with an unguarded rotating shaft on the gearbox within the turbine and died at the scene. The technician's death, which took place on 16 September 2009, occurred after he had escorted the contracting staff up to turbine 18, into the area at the top of the wind turbine where the rotor blades are mounted. Once at the top of the tower, one of the contract engineers began the process to pitch the rotor blades into the off position before locking them off to enable the operator technicians to carry out the inspection.

It was during this process that the technician's harness became entangled in the high-speed shaft coupling, causing him to be pulled in towards the shaft. The emergency stop cord was pulled and the emergency services called. An Investigation found that the gearbox had been inadequately guarded since January 2009, exposing the rotating shafts.

Key Findings:

Risk normalisation appeared to have settled within the organisation with regards to operating turbines without adequate rotating equipment protection in place. A lack of adequate procedures where apparent, resulting in the inspection operation commencing without adequate isolations in place and work party hazard awareness.

Case 2 – Faulty Bottle-Filling Equipment

In June 2017 a worker was killed in a drinks manufacturing facility after the worker's arm was dragged in to rotating equipment while carrying out maintenance. The worker was cleaning a bottle-filling machine when their arm was drawn into the rotating equipment, which continued to rotate. They died at the scene.

Key findings:

The machine was purchased and imported into New Zealand and had not been assessed by a local engineer and thus the equipment was not certified or compliant with New Zealand standards. The machine was not fitted with an interlock which may have prevented it from starting while guarding was open. Although the initial investigation highlighted the lack of an interlock as the primary cause of the incident, we can see a clear finding would be a lack of safe system of work standards such as safe isolation. Should there have been effective supervision and an electrical and mechanical isolation in place it may have assisted in carrying out maintenance in a safer manner.

Figure 1: ISC Framework

The ISC believes that leadership across six key functional elements is vital to achieve good process safety outcomes. These elements are:

- systems & procedures
- engineering & design
- assurance
- knowledge & competence
- human factors
- culture

In the *What can I do* section below you can see how each of these elements plays a part.

What can I do?

Management	
	• Ensure that there are written procedures on the requirements to be in place to ensure guarding of rotating equipment.
	• Ensure that an emergency response team and equipment are available within the organisation.
	• Ensure that changes to scope are adequately assessed and approved prior to any work taking place.
	• Ensure that any equipment purchased for the organisation is brought up to national standards.
	• Ensure there is a maintenance management system that defines how work is identified and scoped.
	• Conduct an effective management of change process which highlights new equipment onsite and the operation of this equipment.
	• Ensure risk assessments are reviewed and updated at adequate time intervals to reflect current conditions.
	• Ensure local training is in place to all staff for safe use of rotating equipment and best practices for maintenance.
Process Engineer/Supervisor	
	• Carry out effective hazard studies on new equipment to ensure it meets required standards.
	• Complete simulated emergency response exercises to respond – wind turbine access being key.
	• Ensure adequate safe system of work are in place such as isolations to allow maintenance work.
	• Ensure that all scope changes are adequately risk assessed and documented. Any changes must be reviewed to ensure the conditions are suitable for ongoing operations.
	• Ensure plant is designed to allow automated isolation in an emergency situation.
	• Pro-actively inspect sites and condition of equipment – lead by example
	• Ensure the knowledge and competence of your team while remote working.
	• Have daily or shift briefs to ensure site teams are aware of issues associated with the plant and process.
Operator	
	• Complete start and end of task checks for abnormal conditions. Stop during task if anything changes.
	• Report all abnormal conditions to management.
	• Ensure worksite visits and effective pre job risk assessment discussions take place.
	• Request to see isolation of equipment prior to commencing maintenance to ensure the site and equipment are safe.
	• Stop the job and report any deviation from the permit to work system including change in surroundings.
	• Ensure sufficient handovers are in use documenting the condition of equipment.