FOCUSSING SAFETY EFFORT - DRAGLINE CASE STUDY

Roger Kahler
The InterSafe Group Pty Ltd

Robert Kent
Tarong Coal

SUMMARY

Hazard studies of key operating equipment was, and is, an objective of CRA corporate safety programmes. Tarong Coal embarked upon such a study of their dragline in 1995 and implemented the outcomes of the study in 1996.
This paper will discuss the methodology used to gather relevant and focussed information on those situations that had the highest potential to permanently disable a person maintaining or operating the dragline. The methodology involved the harvesting of the store of knowledge within the Tarong Coal and contractors' workforces. This knowledge was gleaned against a backdrop of focussing questions that arose from an understanding of the epidemiological nature of permanent and temporary personal damage. That knowledge allowed the documentation of higher risk incidents. This information was circulated amongst dragline owners so as to maximise the dissemination of information and provide opportunity for feedback on proven solutions that may have been implemented on other sites.
The implementation of items identified in the study was a demanding and exacting task. The paper will introduce the design, construction and retrofit practices and systems which were adopted to maximise the greatest change in the shortest possible time while achieving the highest standard of safe working practices.

INTRODUCTION

This paper describes a process of collecting the information and experience of dragline operation and maintenance groups. The purpose of such collection was to obtain insight into potentially permanently disabling injuries relevant to a dragline. This information provided the basis for producing and implementing effective solutions.

FOCUSSED RECALL - THREE STEPS

The process can be summarised in three steps:

(a) Problem identification of potentially permanent damage based on workers' experience and knowledge set against a framework of focussing questions.
(b) Prioritisation of identified problems followed by analysis using an appropriate model to generate solutions.
(c) Implementation of solutions followed by audit to determine effectiveness.

KEY CONCEPTS

There are a number of key concepts which provided the rationale for the methodology which was used. Those concepts are:

- Personal Damage can be categorised
- Personal Damage involves a damaging energy exchange
- Damaging Energies can be categorised
- Damaging Energy occurs as "dose" exchanges
- The vast majority of personal damage comes from non-fatal permanent disability incidents
- Those damaging energies which are "over involved" in permanent damage are known
- A damaging energy pattern will exist for draglines
- The majority of damage comes from "tragedies" not disasters i.e. one off events

Personal Damage can be classified as:

- Class I (Permanent - Fatal and non-fatal)
- Class II (Temporary - Person fully recovers)
- Class III (Inconvenient)

Personal Damage can be considered to occur as a consequence of an energy exchange which exceeds the tolerable limits of the person. Sometimes there is insufficient energy eg. Insufficient oxygen.
The energy pattern involved with non-fatal permanent disability is different from the pattern of damage for fatalities. The major energies involved are:

- Fatalities

  - Mobile Equipment
  - Gravitational - fall from height
  - Machine energy

- Non-Fatal Permanent Disability
  - Human Energy - Simple lifting, pushing & pulling
  - Gravitational - falls from height & same level
  - Mobile Equipment
  - Object Energy

The majority of personal damage arises from non-fatal permanent disabling incidents and their post damage management. The ratio of Class I, II and III damage for Australian industry is -

- CLASS I ⇨ $16.4 BILLION
- CLASS II & III ⇨ $ 3.6 BILLION [1]

Therefore, the focus of recalling a workforce's knowledge and experience must be centred on potential Class I situations.
The "past" is still one of the most powerful predictors of the "future" with respect to risk management. Therefore, we must identify:

(a) the sources of historical information
(b) harvest or tap those sources
(c) organise the information in a meaningful way.

People who work on and with equipment have a depth of knowledge which can provide significant insight into the risk of Class I damage. However, questions must be asked which are relevant to the nature of Class I personal damage.

8 STEP METHOD

There were a number of steps in the overall process of implementing change. The paper places a strong emphasis on the "problem identification" phase and the underlying concepts and philosophy. These are the foundations. A "shaky" outcome occurs if an inappropriate foundation is applied.
In this project, there was little or no opportunity for "trialing" solutions prior to implementation. However, involvement of the "owners" in the process increases opportunity for acceptance, validity and sustainability of changes. Each segment of Figure 1 contains its own key principles. For example, problem identification requires a trained interviewer and a co-operative, willing interviewee.

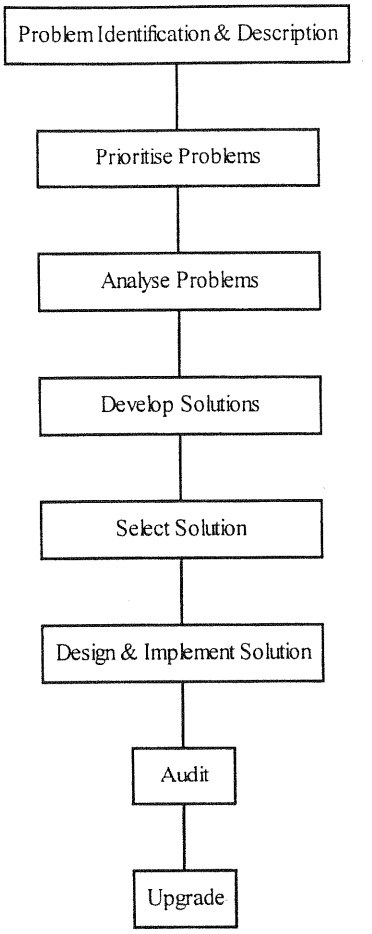

Figure 1

PROBLEM IDENTIFICATION - ACTIVITIES COMPLETED

With these underpinning concepts, a number of activities were established for studying where potential for permanent damage could occur on the dragline. Firstly, system boundaries had to be established for the study.
It was decided to include "that equipment/processes which would require a prolonged shutdown to correct". Therefore, bucket repair was excluded.
The problem identification activities involved:

(a) completing a classification of dragline incidents for the Queensland Coal Industry
(b) engaging two auditors (Electrical Engineer and Mechanical Engineer with extensive experience in understanding and predicting incidents)
(c) interviewing the dragline operators and maintainers in small groups to focus their experience and knowledge of incidents. Focussing questions were based on damaging energies.
An example of a "Gravitational Energy" question would be:

Gravitational Energy - Falls of People - From Higher Level

"Have you observed situations or experienced situations where there was a potential for serious injury if you or another person were to have fallen while working from a higher level or alternatively have nearly fallen but recovered?"

Examples of working at a higher level would be working while on overhead crane beams, structures, ladders, elevated equipment, e.g. gear boxes.

(d) Other groups interviewed were:
- Manufacturers' representatives.
- Maintenance contractors.

REPORTS

The preceding process gathered information that was collated and presented in the following report:

Report - External Auditor

This auditor had an extensive background in industrial accidents. The report was completed following comprehensive inspection of the machine. It was not meant to be a complete and definitive study.

The report was divided into two sections, dealing with the interior and exterior characteristics of the machine. Within each section, the audit primarily focuses on two sources of potentially damaging energy, although mention is made of others. The major categories deal with access (gravitational energy) and guarding (mechanical energy) hazards.

Report - Electrical Hazards - External Auditor

This audit was carried out by Electrical Engineering consultants with dragline experience. It identified hazards that could lead to permanent disability or major equipment damage. The major hazards identified were fire, due to oil filled transformers and circuit breakers, lack of emergency egress from confined spaces, open rotating machinery and switchgear, and inadequate lighting levels.

Report - Potential Damages Sources - Dragline operators

This report addressed items relating to the machinery house, boom, operators cab and activities completed in and on those assemblies by the operators.

The information gathered in this report was itemised and was generally fully described using photographs, energy categories, comments and suggestions.

Report - Potential Damages Sources - Electrical maintenance group

The information gathered in this report contains 36 items which were fully described using photographs, energy types, energy categories, comments and suggestions.

The following are typical items identified:

- Access to House Crane - Gravitational Energy - Fall from Height
- Access to Lube Crane - Gravitational Energy - Fall from Height
- Handling cable Plugs in Boat - Human Energy - Lifting
- Lifting Oil Reservoir Circuit Breakers - Human Energy - Lifting

Report - Potential Damages Sources - Mechanical maintenance group

The information gathered in this report contains 29 items which are fully described using photographs, energy types, energy categories, comments and suggestions.

The following items are typical.

- Adjusting Intermediate Suspension Ropes - Gravitational Energy - Fall from Height
- Ventilation Fans - Human Energy - Lifting
- Fitting Retainer Plates Swing Shaft - Human Energy - Lifting, Pushing

Potential Damages Sources - Information obtained from contractors

The information gathered in this report contained 22 items which were fully described using photographs, energy types, energy categories, comments and suggestions.

The following items are typical.

- Dragline Access - Gravitational Energy - Fall while ascending
- Shovelling/Drag Rope Tray - Human Energy - Shovelling

Reports from other dragline operators

All the previous reports were sent to other dragline operations to inform them of items identified and to seek feedback. Two people (a facilitator and a tradesman) were sent to the northern mines and another two operators to the Hunter Valley to find out how others had overcome the identified problems. An excellent response came from other mines.

PRIORITISATION

It can be observed that there are many potential damaging energy sources recorded in these reports. It was necessary to establish an order of priority of these compiled lists. The documents were provided to the tradesmen to prioritise the first 20 items that they would wish to solve. It was then necessary to collect the documents and assign a score to each item to determine its overall position.

DEVELOPING SOLUTIONS

Solutions were developed by interviewing the tradesmen and operators in small groups and gathering their solutions as well as gathering the suggestions from the other mines. OEM and experienced engineering experiences was collected. Out of all these ideas a solution was proposed that was acceptable to the interested parties.

We were now at a stage where we had a plan of the work to be done. A schedule showed that the work would take approximately 100 men, 21 days working 3 shifts. A hazard management document was prepared using a team consisting of Tarong, Bucyrus Erie, contractor and subcontractor personnel.

This hazard study was conducted at the prestart up stage of the shutdown and focused on all the areas contained in the Tender Document.

Additional hazard studies were conducted for contract extensions.

The Hazard Study involved using a job safety analysis worksheet. It was agreed to jointly by the contractor, Bucyrus Erie and Tarong representatives that all worksheets would be kept in the contractors office. When a task was identified as requiring a J.S.A., it was discussed by the supervisors and the team doing that task. Everyone's name was recorded and signed as being instructed in the hazards and the precaution required to carry out the task in a safe manner.

During the shutdown there were 35 planned safety related jobs to complete. Jobs were grouped ie. the 4 swing motor access platforms were 1 job as were the hoist and drag access platforms. There were 4 jobs that were not started due to lack of time - lowering the walkway behind the MG sets and raising the walkway over the drag rope trough.

There were several other jobs that were completed, however, they required further work to make them perform as required e.g. the hoist and drag motor access platforms. In their present condition they would be better off removed.

The boom walkways were much more difficult to install than we had anticipated. We had not realised that the original steps were at 34 degrees and the boom was at 38 degrees. It didn't make much difference when they were all the same, however, we only replaced the walkways and not the cross boom sections. We will live with it.

Over all the shutdown was a success with several jobs requiring further consideration. One of the biggest problems encountered was the lack of manpower to inspect all the work that was being done before the shutdown. Equipment was made off site and without inspection. This caused a lot of extra work during installation.

CONCLUSION

This paper broadly discusses a methodology of becoming "focussed" with respect to the identification of potential permanent disability arising from dragline operation and maintenance.

Selected problems identified by the methodology have been illustrated. The implementation process with respect to solutions have been described.

The overall result is believed to have produced:

1. A significant reduction in the risk of personal damage.
2. Resolution of long standing, but accepted, problems.
3. Higher level of understanding and responsibility by all concerned.

The process identified the high involvement of "Gravitational" and "Human" energy in potentially permanent damaging energy exchanges. This correlates with actual damaging energy patterns.

REFERENCES

1. Industry Commission, Work Health & Safety: Inquiry into Occupational Health & Safety, Canberra, April 1995