Implementation of an Ergonomics Program Intervention to Prevent Musculoskeletal Injuries Caused by Manual Tasks

Coal Services Health & Safety Trust Research Grant

Final Report Jan 2006

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Summary

This Coal Services Health and Safety Trust project comprised a feasibility study conducted between July 2001 and March 2002, and the main study conducted between January 2003 and December 2005. The aim of the project was to evaluate the implementation of a participative program for manual tasks injury risk reduction (PerforM). Nine sites (4 surface and 5 underground) were involved to varying extents across the project as a whole, with the implementation of the PErforM program being undertaken at 6 of the sites (2 surface and 4 underground). A total of 91 site visits were made and 482 miners participated in manual task risk management training and workshops.

The risk assessment and control suggestions documented in this report provide evidence that the participative ergonomics process employed is an extremely effective way of assessing risks and generating potential control solutions, and this was true at all sites involved. Greater variability was evident in the success in translating the control suggestions into implemented solutions. The sustainability of the program also varied, with the activity petering out in some sites, continuing through the activities of an "ergonomics task group" at one site, while at another, the process has been adopted as a site standard. This report concludes by discussing the lessons learned about the implementation of the program at surface and underground coal mines. Whilst there is no doubt that the participative ergonomics process has the capability of producing effective control solutions, achieving this potential and translating the results into reduced risk exposure requires the genuine commitment of management to implement control measures identified during the project. Equally important is that this commitment is perceived to exist by the workers. Consequently, the role of the facilitator of participative ergonomics often needs to extend beyond purely providing manual tasks risk management skills, but also to facilitating communication between management and workers. Other threats to the successful implementation of control suggestions include turnover of key personnel and failure to ensure sufficient participation in the implementation.

The results of the project have been progressively disseminated to the industry through eight presentations at Coal Services Health and Safety Trust seminars at Emerald and various NSW locations. Papers concerning the project have been presented at Queensland and New South Wales Mining Safety Conferences; as well as conferences in Pittsburgh and Brisbane (Burgess-Limerick et al., 2005). A paper concerning the project has been submitted to the *International Journal of Industrial Ergonomics.*

Background

Musculoskeletal injuries caused by manual tasks are the single most frequent cause of compensation claims involving lost time greater than 5 days, accounting for approximately 1/3 of all such claims. Within the coal industry, these injuries are commonly associated with the use and relocation of plant, manual handling of materials and equipment, and aspects of the physical work environment.

Authorities in a range of jurisdictions have been examining means of combating this problem, with the consensus that the implementation of a general ergonomics program based on employee participation is most likely to result in a positive outcome. For example, the United States General Accounting Office evaluated the effectiveness of a range of ergonomics programs, and found that ergonomic training programs produced significant improvements in injury rates and compensation costs, provided these programs were supported by management and maximised employee involvement (GAO, 1997).

Closer to home, Workplace Health and Safety Queensland (WHSQ, 2000) promulgated a manual tasks advisory standard in 2000. Members of the research team collaborated with WHSQ on a randomised controlled trial which evaluated the ability of a Participative Ergonomics for Manual Tasks program (PErforM) to reduce manual tasks related injury risks. The project was undertaken with funding from Workcover Queensland and the National Health and Medical Research Council, and focussed on a diverse range of industry sectors within Health, Food Processing and Construction industries. The results obtained from 31 experimental workplaces and 20 randomly assigned controls demonstrated a significant reduction in injury risk as assessed by WHSQ inspectors (Straker et al., 2004).

The aim of this project was to evaluate the implementation of such an intervention in the Coal Mining industry. To do so, we adopted a participatory approach to manual task risk reduction which takes as a framework a risk management cycle of hazard identification, risk assessment, risk control and evaluation. A hierarchy of risk control strategies was also adopted, with design changes to remove or reduce hazards preferred, and 'administrative' controls such as task rotation or skills training suggested only when 'engineering' controls cannot be developed. This participative approach differs from "external expert" approaches in the assertion that workers performing the manual tasks are the 'experts' and that, given sufficient training and motivation, work teams are in the best position to undertake hazard identification, risk assessment and risk control activities (see Haines and Wilson, 1998 for a review).

A participatory approach requires work teams to be knowledgeable about the risk management framework and be able to assess and suggest potential controls for manual task risks. Training workers to acquire these skills and work within a risk management framework is consequently a key concern. Team members identify hazards in their work and are facilitated through a risk assessment process which requires them to develop control suggestions. The work teams plan the implementation of key controls and are subsequently shown how to evaluate those controls. Management commitment and effective risk management systems are likely to be required for the approach to be effective, and access to external ergonomics expert assistance may be required for particularly difficult or complex problems.
Proposed benefits (Straker, 1990) of the participative approach include:

- expertise of workers is used to identify problems and solutions resulting in a better quality of risk assessment and control
- workers develop ownership of the process and are consequently more likely to support rather than obstruct suggested changes to work practises
- improved team work and team cooperation
- positive impact on general safety climate and culture

Some work has previously been undertaken outlining the application of ergonomics in coal mines (Andrew & Simpson, 1993; McPhee, 1993), and mining more generally (Gallagher, 1998). There is also a considerable history of investigations of the role of autonomous work teams in coal mining (Trist et al, 1963). However, as Culvenor et al (2000) noted in their review of occupational health and safety priorities for the Australian coal industry, there is a lack of research in the area of manual tasks injury prevention, both nationally and internationally.

In mining, as in industry more generally, we believe the focus of preventing manual tasks injuries must be on reducing overall manual tasks risk factors. What is needed, as Simpson (2000, p.262) puts it, is "a detailed and systematic risk assessment system" and "a little more creativity and imagination when developing risk control measures". The aim of this project was to provide the necessary risk assessment system, and harness the creativity and imagination of workers through the participative ergonomics process.

What we did

Feasibility Study

A feasibility study was undertaken between July 2001 and February 2002. The aims of the feasibility study were to:

- Assess the critical OHS issues within representative mine sites;
- Evaluate the appropriateness of the ergonomics program; and
- Tailor the program and materials to address the unique demands of the coal industry.

These aims were achieved through 10 site visits to three open cut and one underground coal mine. Survey data were collected from a total of 175 staff at three sites, and interviews were held with staff and management at each of the mines. An audit of OH&S management systems relevant to manual tasks was undertaken at three sites.

The training materials and processes were tailored to the coal industry through the use of the information and video footage obtained in the initial visits to each site. The training materials and processes were trialed with 46 staff at one open cut coal mine in training sessions spread over seven days. The training program was successfully adapted to the coal mining context and, following the training, staff were able to assess manual tasks risk, and suggest controls for those risks. Results of the feasibility study were presented at JCB Health & Safety Trusts seminars in Rutherford and Emerald in February 2002, and Sydney, Emerald and Cessnock in 2003. Presentations were also made at Queensland (Townsville) and NSW (Terrigal) Mining Safety conferences in 2002. A presentation describing the project was also made at the USA National Occupational Injury Symposium (Pittsburgh, October 2003).

On the basis of the interviews undertaken with staff and management of the mines involved, survey data gathered from 175 staff in one underground and two open cut coal mines, and the audit of OH&S management systems undertaken at three sites, the following conclusions were drawn.

- Site Management are acutely aware of the ageing nature of their staff. At most sites the average age was 45-50 years.
- The workforce, especially older workers, are concerned with their health, and the implications of musculoskeletal injury for their long term functional abilities.
- Many workers are aware of current musculoskeletal complaints, however they were reluctant to seek assistance because of a fear of forced retrenchment as a consequence.
- The standard of OH&S management systems was generally very high, and the workforce demonstrated a good working knowledge of OH&S risk management. There were some indications that whilst systems for consultation may exist, they are not always used. This may suggest the need for specific campaigns in different hazard categories eg., manual tasks. The ergonomics program provided is likely to facilitate such a process by assisting with risk assessment and identification of control measures. Further details of the management systems audit is provided in Appendix A.

Additional funding was awarded by the open cut committee of the Australian Coal Association Research Program to enable a complementary project to be undertaken. This project focused on open cut mining only, and aimed to determine whether manual task risk controls developed at a sample of open cut coal mines may be implemented on an industry wide basis through the compilation and dissemination of a handbook for the control of musculoskeletal injuries in open cut coal mining (Burgess-Limerick et al, 2004).

Main Study

Having revised the materials and processes on the basis of the feasibility study, we proposed to implement and evaluate the implementation of the program in an additional 5 coal mines. Following ethical approval for the project, a number of sites were approached regarding participation. Given that a surface site (Tarong) had participated in the feasibility study, and that related activities funded by ACARP were undertaken exclusively within surface coal mines, it was decided to focus on underground mines, and the program was subsequently implemented at four underground mines (Crinum, Oaky Creek, Metropolitan & United) and the coal handling and preparation plants at a surface mine (Blackwater). Table 1 presents the breakdown of visits and miners trained throughout the project.

Year	Site	Visits	Miners trained
2001	North Goonyella	1	
	Tarong	5	46
	Ulan	1	
	Gregory	1	
	Crinum	1	
2003	Gregory	2	30
	Crinum	20	116
	Oaky Creek	13	30
	Metropolitan	1	
2004	Crinum	5	
	Metropolitan	3	10
	Blackwater CHPP	19	89
	United	8	135
2005	Metropolitan	6	26
	United	5	
	TOTAL	91	482

The assessment of manual tasks risks in PErforM is conducted using a simplified version of Manual Tasks Risk Assessment tool (ManTRA) which was devised for use by Workplace Health and Safety Queensland inspectors during workplace audits (Burgess-Limerick, 2004a; Straker et al., 2004). The simplified version requires assessors to nominate the body region or regions at risk and to provide a rating on a five point scale for each of five risk factors (Exertion, Awkward posture, Vibration, Repetition and Duration) for specific body regions. The scores are used to provide a "risk profile" for that body part, and assist with identifying aspects of the tasks to which control measures should be targeted. Training in the use of this tool is assisted through the use of industry specific, and workplace specific, video footage. The risk assessment training focussed on providing an understanding of the direct risk factors highlighted in the PErforM risk assessment tool, using industry specific footage to develop a shared understanding of use of the tool provided to assess exposure to each risk factor. Training in manual tasks risk control highlighted the importance of the hierarchy of control measures, and of the importance of ensuring all avenues for elimination, or control by design, are explored in prior to resorting to administrative controls. Appendix B provides extensive examples of the results of these processes, and demonstrates the effectiveness of the process in facilitating meaningful risk assessments and eliciting suggested controls.

What we have learned

Management at the coal mines are acutely aware of the substantial compensation costs associated with the manual tasks related injuries sustained by their staff. They are also extremely concerned by the increasingly older age profile of their workers. Workforce turnover in the industry, although not between sites , is low, and the general industry trend is toward leaner workplaces producing more coal with fewer people. The need to reduce exposure to cumulative loading is appreciated by management. Considerable progress has been made in surface mines to reduce the manual tasks involved. In contrast, despite large advances in mining technology, underground coal mining is still characterised by relatively high exposure to hazardous manual tasks. Whilst "production" looms large in the consciousness of management, there is also a genuine commitment to safety. In short, there is generally evidence across the participating workplaces of management commitment to reducing manual tasks risks.

The risk assessments and control suggestions documented in Appendix B demonstrate that after a relatively short training period, and given appropriate tools, coal miners are able to undertake manual task risk assessment and generate potential control options. The use of industry and workplace specific video footage during the training has again proved to be an effective way of both conveying the skills and knowledge required, and also in maintaining motivation and attention of the trainees.

The mines involved have highly developed safety management systems, and this creates an opportunity for skills in manual task risk assessment and control to be utilised and for design changes to be implemented. Conversely, the size of the organizations, and the complexity of the workplaces, creates challenges for ensuring that the control suggestions resulting from the participative ergonomics process are evaluated, trialled, and implemented. The processes employed across the sites to achieve this varied, had had varied success. At one site an "Ergonomic Task Group" was successfully incorporated into the site activities , meetingon a monthly basis. The group's role is evolving and includes: (i) sharing ideas with employees regards any controls to mitigate manual task risks, (ii) reviewing equipment overhauls and purchasing of new equipment; (iii) advocating for any interventions that may result in reducing manual task risks. Another site has integrated the PErforM process within it site standards (Appendix C).

The additional hazards of working in an underground environment, such as the overriding concern regarding the control of ignition sources, means that implementing controls for underground coal mining can be particularly slow. Materials that may be available for use in an above ground operation (such as aluminium) cannot easily be introduced in the underground coal environment. Certifying new designs takes **time.** This can be frustrating for the workers concerned, and lead to a feeling of dissatisfaction with the process. The initial implementation of quick controls, even if they are not the highest risk tasks, may be beneficial.

A person onsite who drives the process appears to be essential - this person needs to have easy access and support from management to proceed with projects. This site "champion" is crucial. Sites where such a person did not emerge, or did not stay at the site, struggled to realise implementation of the suggested controls.

While team supervisors were encouraged to participate, they sometimes chose not to, reasoning that their presence may influence the willingness of crew members to contribute to the processThus, a degree of experience was sometimes missing from the teams performing the risk assessment and control exercise. The supervisor was also an important link in the management chain to the level where decisions about time and costs would be made. A high level of commitment from the supervisor was a factor that contributed to the successful and timely implementation of control measures.

It is important, particularly given the delays that typically occur, that communication with the teams involved in a project is maintained. Even if there is no progress to report it is critical that workers understand that the process is still underway. This was well handled at the site where an ergonomic task group was formed following the implementation of the project. The group represent a broad cross section of the employee body, including, maintainer / operators, Health and Safety, Management and Engineering. The ergonomics task group was responsible for prioritising high risk tasks to be addressed based on their communicating with their crews and seeking ideas and feedback. There is a great opportunity for developing new skills with the task group attending additional training for manual task risk management and ergonomics. The crews have been very receptive to the discussion and minutes that come back to them. Some of the tasks on the agenda recently included: redesign of an LHD to reduce the whole body jarring, dismantling of belt structure, and retrofitting a jib to be used to deliver longwall legs to the tailgate end of the longwall. Management at this site have recently approved paid overtime attendance for those attending these meetings on their days off.

The attractiveness of the participative ergonomic process is the sense of ownership that is developed over a control idea that is implemented. In discussion with management within some of the mine sites, most have been able to identify one or two controls that have been implemented over the years that just didn't "catch", at some expense. It is likely that a lack of participation is to blame in at least some cases.

In the process of taking an idea and creating a design, engineers may sometimes fail to check in with the end "user" throughout the cycle and consequently fail to produce a product which satisfies the real needs. An example of this occurred at one site where a longwall crew developed an idea for a trolley to be run along the longwall face to transport equipment. The engineer designed a sufficiently large trolley to allow it also be used for less regularly moved, and even heavier, pieces of gear as well as the load intended by the miners. The miners have declared the weight of the trolley excessive and have continued to carry all items in pairs or use the slow chain block procedure of feeding the equipment along the "face". This problem may have been avoided if the participative approach was embraced and feedback sought throughout the development of the

control. A lighter more usable trolley was subsequently fabricated after the introduction of the site ergonomics task group
There are significant obstacles to communicating directly with employees in an underground setting on shiftwork. Seeking feedback for a change or modification to plant and equipment is not easily done and was not often done very well. There was often a lack of communication between different crews (i.e. day, afternoon and 'dog-watch' shifts). This manifested some problems in terms of coming up with a consensus for control measures. (eg., one crew wanted the design of the rails to be changed on the continuous miner despite the fact that other crews had previously designed the current design to work for them). There was also a general perception that management followed what a particular crew (usually day shift) said more than other shifts. In addition this lack of communication often surfaced in the workshop sessions where one crew had an effective technique for performing a task whereas other crews were struggling with the same task.

Another example occurred when at one workshop session the miners' major control measure was to design a rig to help install over-head pipes. At a subsequent workshop another crew pointed out that such equipment had already been designed and built, and was sitting unused in a section of the mine as no one liked it. When probed as to what was wrong with it, nobody knew.

At one surface mining site the management decided to provide each crew with a budget which was their's to use on the control of choice. The crews were required to democratically determine the control they wished to implement. Some examples of interventions made by these crews included: (i) improvements in access to and removal of sump pumps - the sump pump area was modified to reduce awkward stooped back postures, maintenance on a monorail system has reduced forceful exertions and improved productivity on the job; (ii) trial and purchase of some new dozer seating and a job rotation system has reduced the impact of whole body vibration; (iii) the back tray of the coal sampling vehicle was modified to reduce forward bending postures coupled with forceful exertions, some coal sample points have been modified to reduce awkward back postures and excessive forward reach of the shoulder; (iv) modification of the train-loading workstation to reduce awkward and sustained neck postures.

If an idea has been trialled and "failed" a few years ago it may be worth revisiting the concepts and considering alternatives in light of subsequent technical developments. This is difficult to do without available documentation. Documenting both successes and failures is an important step, but one which is not systematically achieved at most sites.

Workforce turnover is a factor that has affected the progression of control ideas at some sites. People responsible for overseeing changes and designs leave and the ideas often depart with them. This occurred at one site during the project where a member of staff left and with him went all knowledge of a trial he had just conducted for a short term control for belt lifting.

The PErforM training materials were easily understood and the risk management approach and control hierarchy is a familiar strategy to all in the mining industry. An impressive product of the risk assessment tool is the speed with which both the nature of the risk and the suggested control ideas are generated. The information obtained typically requires considerable refinement following the "brainstorming" stage, however, the benefits of having a number of experienced operators involved in the process can not be over-stated.

It is at the "refinement" stage that the process has the greatest potential to break down. The expertise drawn upon to identify the nature of the risk and to suggest control ideas may not be the same expertise that is needed to design and implement the controls. Input from other areas may be required for a variety of reasons, including:

- Ensuring that materials introduced into the underground environment are intrinsically safe
- Ensuring that the use of new controls will not create a flow-on effect on any other part of the operation
- Ensuring that costs are realistic
- Ensuring that controls comply with regulatory requirement, site and company guidelines

Whilst there is no doubt that the participative ergonomics process has the capability of producing effective control solutions, achieving this potential and translating the results into reduced risk exposure requires the genuine commitment of management to implement control measures identified during the project. Equally important is that this commitment is perceived to exist by the workers. Consequently, the role of the facilitator of participative ergonomics often needs to extend beyond purely providing manual tasks risk control skills, to also facilitating communication between management and workers. Other threats to the successful implementation of control suggestions include turnover of key individuals and failure to ensure sufficient participation in the implementation.

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Appendix A

Feasibility Study - Results of the OHS Management System Audits

The following were tools used to collect information to gauge the effectiveness of the OHS management systems at the 3 sites:

- Workplace Health and safety management system audit questionnaire, “Tri-safe” which was developed by the Division of Workplace Health and Safety.
- Supervisors checklist.
- Purchasing officer’s checklist.
- Manual task risk assessment survey.

The Health and Safety management system at each site was reviewed under the ten categories outlined in Tri-Safe. The effectiveness of the local management systems was reviewed based on workplace outcomes. Although only three sites were audited, the findings provide some indication of the level of the health and safety systems implemented on an industry and site by site basis. The information is able to provide some broad indicators on how health and safety is being implemented and areas of recommendation. Further auditing of more sites would ensure a more representative finding on the current status of these systems in the industry and specify in more detail the areas where improvements can be made. In particular as only one underground site has so far been audited, more underground mines are required to provide more definitive conclusions.

Overall all the sites had fair to excellent established and document systems to manage risks to the health and safety of workers and others arising from the nature of work performed, equipment, materials used and the work environment. There were considerable differences in the maintenance and evaluation of the effectiveness of their systems. This trend had been noted across other industries. Regular review and evaluation of the effectiveness of each component of the implemented systems is vital in ensuring that the risks at the workplace are being properly and efficiently managed. All three sites demonstrated compliance to the basic requirements of a workplace health and safety system. One of the participating sites demonstrated best practice in a number of the categories in this review.

Health and Safety Policy Communication
All sites had in place a health and safety policy that covered the basic objectives of a good workplace health and safety policy. There was significant variability between sites on how regularly the policy was reviewed and the level of awareness by the workers of the policy. One site reviewed its workplace health and safety policy following a significant workplace health and safety event or on a yearly basis, whichever came sooner. Workers reported that they became aware of the health and safety policy at their workplace through different avenues especially through induction training and group meetings. Fewer workers noted that became aware of the policy through their manager or supervisor or in their procedures manual.

To achieve best practice in this area, sites could improve communication of the policy to all employees and others at the workplace through inclusion of the policy in procedure manuals, contract documentation, through the supervisor and manager.

Allocated responsibilities and accountabilities
Across all sites both management and supervisors had received formal (both written and verbal) communication of their workplace health and safety responsibilities. It was noted that better description of the workplace health and safety responsibilities and accountabilities in the duty statements for each position would be helpful. Some sites did not specify the workplace health and safety responsibilities for workers in their duty statements or other written communication. This should be a key inclusion to communicate to workers their duty of care in the workplace.

These accountabilities have been incorporated into the annual performance appraisal of managers and supervisors at all sites. One site also includes this during their 6 monthly appraisal. Management and supervisors appeared comfortable with the workplace health and safety responsibilities and accountabilities of their positions. However the performance measures used in performance appraisals appeared quite generalised. If the performance measures were more specific and objective it would provide direction and specific objectives for management and supervisors to work towards and for their performance to be more accurately and easily to be assessed. An industry guideline on how to implement more specific and objective workplace health and safety performance measures would be useful. Assistance in how to review progress of these measures would also be helpful to produce best practice. This is an area that other industries are also lacking.

More regular feedback to management and supervisor on the effectiveness of their performance within the allocated responsibilities could help make the roles more effective.

All mines had identified positions that were responsible for achieving specific health and safety objectives. Workers indicated a very high awareness of the person in this position.

Suppliers, sub-contractors and purchasing controls

The majority of mines could improve here. Currently all sites have some procedures in place to conduct risk assessments prior to purchasing major equipment or plant and to monitor the health and safety performance of sub-contractors.

Although methods are available for each site to conduct risk assessments prior to purchasing equipment and plant or engaging a supplier, it is not undertaken consistently across a wide range of basic and specialised equipment and plant. At times the head office of the organisation also determines the equipment or plant to be purchased and the local sites have not participated in the decision. For accurate assessment of the workplace health and safety risk associated with any purchase consideration of local factors that may interact with the equipment is necessary. Improved communication and participation with representatives from the local site is required to ensure suitability of equipment for the local site and to minimise health and safety risks. Ideally a worker who will be using the equipment or plant should be involved in a pre-purchase risk assessment.

Manual task risk factors were considered very infrequently for the equipment or plant assessed prior to purchase. Assessments need to address the potential manual task risks. Greater emphasis on manual task risk factors need to be included in risk assessments, particularly for equipment used by a wide range of workers and those used for long durations or high frequency. The manual task risk factors that maintenance workers are exposed to also need attention. Poor design of many pieces of equipment and plant have been frequently identified as the main cause of the high risks associated with a number of manual tasks routinely undertaken by in maintenance workers.

There is industry wide acknowledgment that there is limited range of specialised mining equipment and plant available. There is a lack of competition in specialist mining plant with only two major manufacturers worldwide. A high level approach by senior management between the manufacturers and a consortium of large mining corporations with Australian mining operations is required to improve the design of the specialised mining plant to minimise musculoskeletal injuries. This could be supported by active pursuit by the statutory workplace inspectors to enforce the manufacturer's duty of care in the prevention and minimisation of workplace injuries. This would require the support of the statutory authority. There needs to be a greater uptake by manufacturers to follow through with their responsibility to improve the design of equipment to reduce workplace injuries.

The availability and use of pre-purchase guidelines would assist with the assessment of manual task risks. It would provide guidance and prompts for the purchasing officer /workplace health and safety staff to more easily and efficiently address basic manual task risk with equipment or plant. Specialised pre-purchase guidelines could be produced for equipment that is commonly purchased. These guidelines could more specifically assess the physical features of equipment that are used frequently and by a high proportion of workers. If inappropriate equipment is purchased, continued use of the equipment usually occurs until it requires replacement through wear and tear. Specialised pre-purchase guidelines have been used very successfully in other industries to assist in the selection of new equipment.

The use of these guidelines needs to be supported with training for head office and site purchasing officer in manual task risk assessment and encouragement for purchasing officers to work closely with workplace health and safety staff.

Another key component of successful/ good equipment selection is the trial of equipment prior to purchase. Trials will quickly identify the functional difficulties associated with the equipment and highlight how appropriate the equipment is for the intended work task. If possible a good trial will involve a few different models. This provides better comparison of the features of the equipment and enables better selection of appropriate equipment. Without comparison between different models, the sole model trialed may be the one purchased regardless of whether it may or may not be the best one for the task. Feedback on the trials can also be valuable for other sites in the corporation that are intending to purchase similar equipment. This is also a part of a good management system where there is consultation with workers on health and safety matters.

Sub-contractors

All sites supply basic health and safety instructions to sub-contractors on arrival to the site and provide on-going health and safety information. One site demonstrated best practice in the management of its sub-contractors. This site conducted random audits on sub-contractors health and safety, included them in regular observations of work practices and feedback the information promptly. The action following health and safety reports undertaken by the supervisors of sub-contractors at this site is expected to be at the same standard as mine supervisors. Other sites did not appear to monitor or evaluate its sub-contractors' workplace health and safety performance closely after their initial induction onto site.

For best practice, sites should incorporate their health and safety policy into tendering and contract documentation and outline the expected health and safety performance standards into contract documentation with suppliers and sub-contractors. This should be addressed at both the head office and local level.

On most sites, communication of the expected standard of performing manual tasks is not well performed between the site management and sub-contractors. More effort is required from the site management to achieve and maintain their expected health and safety standard by their sub-contractors. There was variation between sites in whether sub-contractors' reported incidents and injuries were included in the mine's own incident and injury rates and their LTIFs.

Workers commented on their questionnaires and through interviews that they noticed the difference between the accepted standard of workplace health and safety by sub-contractors and mine workers. Generally mine workers believe that the sub-contractors' workplace health and safety performance is below the expected standard at the site and that there would be greater compliance to their own standards if sub-contractors meet these standards as well. Workers expressed concerns of the lower workplace health and safety standards that sub-contractors worked in, the lack of assistive equipment for sub-contractors and the more laborious work sub-contractors had to perform.

Industry guidelines could help improve the overall health and safety of sub-contractors at mine sites. More specific objectives would clarify the expected standards and guidance for both the site and the sub-contractors. This would include: inclusion of the health and safety policy into any contract documentation, review of health and safety performance in tendering process, agreed measures of health and safety performance from sub-contractors during progress of work.

Health and safety consultation

Health and safety consultation consistently rated high to moderate across the sites. During the site visits it was noted that health and safety communication between managers and supervisors with workers was undertaken more frequently and in more depth in the coal mining industry compared with other industries participating in the perform program. This may reflect the more serious consequences of the inherent hazards in coal mining.

Workers indicated that there was a very high awareness of the site's workplace health and safety officer in all sites, with a moderate to high awareness of health and safety committee and a slightly lower awareness of health and safety representative consistently across all sites. The workers from one site reported a very high degree of consultation on workplace health and safety matters. This could be reflected in the high degree of consultation with workers across other areas such as human resources.

One area of improvement that all sites could integrate into their management system is the monitoring and evaluation of the effectiveness of health & safety consultation at the workplace. Guidelines would help sites to formally review this area. This could be particularly helpful at sites where there appears to be a significant barrier or separation between management and workers.

Hazard identification, evaluation and control
All sites utilised the risk management approach to address workplace health and safety hazards. There appeared to be good documentation of the procedures available to support the approach. Some sites had written specific procedures for tasks involving high risks. The procedures were incorporated into their incident and accident reporting forms.

The workers at one site reported that they were active in hazard identification with regular job analysis and job/safety observations. Workers from other sites did not report that they undertook this on a regular basis.

Although all the sites have implemented these procedures, there is concern to how effectively they are being utilised. Some sites appeared to be using only hazard identification, evaluation and control in their incident and reporting forms. There was a lack of evidence that these sites were actually using the risk management approach other than for these occasions. To have an effective risk management approach it should be undertaken on a regular and planned basis. For example one site has regular planned audit and risk assessments throughout the year. Another approach could involving targeting a hazard category for a particular month in the year.

Mechanisms to evaluate effectiveness of this system could include more planned workplace inspections, as well as reviewing completed risk assessments, accident/incident reports and workplace health and safety committee minutes.

On review of completed manual task risk assessments there appeared to be a tendency to rely heavily on administrative types of control such as more training rather than design controls such as modification of equipment or workstation to address manual task risks. There is a concern that administrative controls are used as the long and medium term solution for these tasks, without consideration of implementing any design type controls.

Workers have agreed that a relatively high proportion of reported accidents have been investigated and controlled. However there may be the low reporting of incidents by workers who felt insecure about their job. One site demonstrated efficient follow up of incident and accident reports. This site found a commercially available software package that assisted with management, particularly the tracking and documentation of the incident and accident reports.

As part of controlling workplace hazards evaluation and review of implemented controls is necessary. Commonly recommended controls have included use of safe work procedures for high risk tasks. These need to be regularly reviewed the effectiveness of these procedures especially when equipment has been replaced or modified.

Across many industries, workers frequently report that they have not been informed of the results of the decision on the control measures decided by the workplace health and safety committee or management. They stated that they felt the issues that they had raised and made suggestions for reducing the risks were not being considered. This highlights the need for timely communication with workers on progress of the action or decision on reported hazards, incidents or accidents. At workplaces where prompt communication and implementation of some control measure for the identified hazard occurs, the workers appear to have greater confidence in the health and safety management system and feel that management are genuinely supporting health and safety at their workplace.

Provision of information
All sites met the intent of this category in the provision of information without difficulty. They all demonstrated the ability to acquire knowledge of current workplace health and safety legislation, manufacturers' and suppliers' standards and changes in their management system. There are systems in place to restrict the movement of visitors into and throughout the workplace. Relevant information is usually passed on to visitors verbally rather than in written form. There are various methods of disseminating information of changes through the site or company such as notice boards and inclusion in training programs. However these avenues to disseminate information relating to the changes are not always used. Workers stated that there appears an inconsistency to informing them prior to the change in their workplace being implemented. It is important workers are informed of changes prior to implementation, particularly as it could result in adverse consequences, such as changing the equipment without informing workers could result in unintentional misuse of the equipment and injuries could result.

As with all categories, using some method of evaluating the effectiveness of the information provided would be best practice. This may include review of training and procedures manuals, testing awareness, job observation and informal inspections.

Maintaining health and safety information is another element of this category that is undertaken with widely differing standards across the sites. All the provided information needs to maintained and recorded, such as keeping current and relevant notices on notice boards and maintaining all relevant written health and safety information in an easily accessible location.

A common issue faced by many industries is to ensure that the information is provided in consideration of any literacy barrier. Management and workplace health and safety staff appear aware of this issue and have used various strategies to address this issue. For example reading out important information at team meetings and not solely relying on written notices on the notice board.

Training

All sites had evidence of detailed induction training programs for new workers. This is in line with the health and safety material produced recently by the mining industry's training body. There was variability in the training of the health and safety aspects of operational work once initial training has been completed.

A moderate proportion of workers reported that they had received informal training specific to their job by other workers, that is "shown ropes by workmate". Slightly fewer workers indicated that they had received formal training for their current role. The same number reported that they had received supervised on the job training.

A moderate to high proportion of workers across all the sites reported that they received additional training when new equipment/tools or new work procedures were introduced.

Training of supervisors in helping them carry out their allocated health and safety responsibilities is important in any workplace. This may include accident investigation training or training in supervisory techniques. This was well done in one mine, but not consistently across sites and for all supervisors. The overall standard in training of supervisors appears to be higher than other industries.

All sites appeared to maintain induction and health and safety training records.

Evaluation of the information provided (as outlined above) could also be used to evaluate the material provided in training. Additional training evaluation could also be undertaken to ensure internal training quality is maintained.

For better management systems training programs should include procedures for high risk jobs on the site.

Workplace specific issues – manual tasks

All sites appeared to have systems in place to ensure that current health and safety legislative requirements as they impacted on the site specific operations were met. For these sites it included ticketed forklift drivers and operators of heavy plant, register of hazardous substances and dangerous goods on site and material safety data sheets (MSDS).

In relation to manual task hazards, there was wide range in how well it was managed. One site worked thoroughly to ensure that manual tasks were undertaken at best practice. In doing so, meeting all the legislative requirements, Australian standards, codes of practice/advisory standards and external consultant's recommendations. Other sites had systems in place to achieve a similar standard, however they had not actively assessed many tasks for ergonomic risks. This has been highlighted in the discussion of the hazard identification, evaluation and control category. These sites stated that they see the Ergonomics program as an opportunity to kick start assessment of manual tasks. Similar recommendations outlined in the hazard identification, evaluation and control category would apply for manual task workplace specific issues, particularly better identification of manual task hazards.

Workers reported good management of the use of personal protective equipment (PPE) across all sites. This includes issuing of PPE, ensuring it is worn, ensuring it is maintained, PPE is replaced as necessary and training is provided in its use.

It was noted that all sites had worked on their safe work procedures, maintenance programs and training programs towards meet the requirements of this category.

Reporting and investigating
All sites have written evidence of reasonable investigation and reporting systems, which is being used by workers and supervisors. There is evidence at the sites that the records are maintained and investigations into accidents occur. A high proportion of workers agreed that manual task related accidents they have been involved in or have witnessed were investigated. A slightly lower proportion of workers stated that steps were taken to prevent this accident from happening again.

A strong recommendation for all sites would be to evaluate the effectiveness of the investigation and reporting system. For example, by reviewing outcomes of reports, review of the quality of information from investigations.

Appendix B

Risk Assessment and Control Suggestions arising from PerforM training and workshops.

Appendix B: Example Manual Tasks Risk Assessments & Suggested Controls

Summary of Manual Tasks Assessed at BMA CHPP (North)

Below is a list of tasks identified by the operation crews at Blackwater North CHPP as manual task areas of concern.

Manual tasks elected for consideration

1. Changing out sump pump
2. Sieve Bends
3. Dozer seating
4. Loader seating
5. Dozer access
6. Load out seats
7. Boorgoon Load out point: workstation/ cleaning window
8. Changing rollers
9. Large hoses in plant
10. Magnet cleaning
11. Lumps in no. 11 feed chute
12. Jameson valves
13. High level wire
14. Cleaning No.8/3 tunnel

The Coal Sampling group have listed the following areas as particularly needing attention:

1. Loading and unloading samples from the back of the Sampling vehicle
2. Access at the product point is hazardous with the required stair climb while carrying a bucket or two.
3. The borgoon sampling point is poorly designed and promotes poor manual handling technique
4. Tipping samples into the "large hopper" at above shoulder height and then lifting sample from floor level.

Following, is a summary of the tasks that have been assessed to date and the suggested control measures.

MANUAL TASKS RISK ASSESSMENT FORM

DATE & WORKPLACE

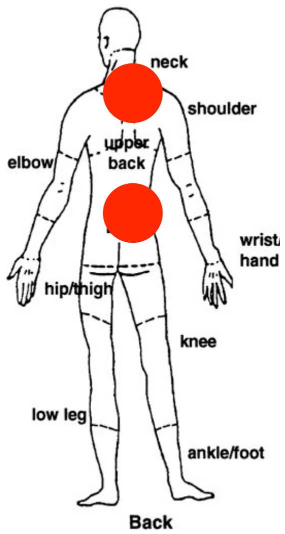
Date:10/5/05	Workplace: Blackwater CHPP

Name of task : Removing Sump Pumps

RISK ASSESSMENT

Exertion				
1 No effort	2	3 Moderate force & speed	4	5 Maximum force or speed
Awkward posture				
1 All postures neutral	2	3 Moderately uncomfortable	4	5 Very uncomfortable
Vibration				
1 None	2	3 Moderate	4	5 Extreme
Duration				
1 < 10 minutes	2 10-30 min	3 30 min – 1 hr	4 1 – 2 hrs	5 > 2 hrs
Repetition				
1 No repetition	2	3 cycle time < 30 s	4	5 cycle time < 10 s

Body part



Comments

Conditions of work are very difficult: Confined space, humid and wet conditions, poor lighting.

RISK CONTROLS

DESIGN CONTROL OPTIONS

- Install external sumps
- Pump installed outside with suction in tail pit (similar to high wall pump)
- Design belt above ground
- Smaller more compact/efficient pump
- External access from Northern side of tunnel
- Redesign the access with the following considerations:
    1. Remove drip tray – to increase vertical space
    2. shorten the conveyer
    3. Install small monorail system above pump and/ or designated lift points
    4. Remove the ladder and excavate steps into concrete or replace with rung ladder.

ADMINISTRATIVE CONTROL OPTIONS

- Use of cap lamps to improve lighting and free up hands for the task
- Paint the pump area white to maximise lighting

MANUAL TASKS RISK ASSESSMENT FORM

DATE & WORKPLACE

Date:10/5/04	**Workplace:** Blackwater CHPP

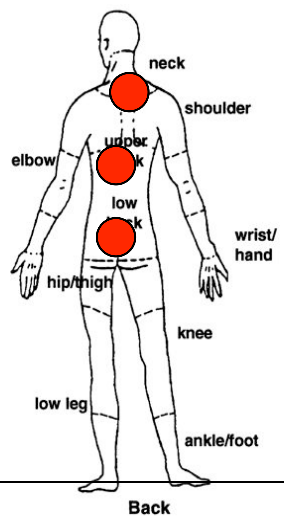
Name of task : Operation of Dozer (seating)

RISK ASSESSMENT:

Exertion				
1 No effort	2	3 Moderate force & speed	4	5 Maximum force or speed
Awkward posture				
1 All postures neutral	2	3 Moderately uncomfortable	4	5 Very uncomfortable
Vibration				
1	2	3 Moderate	4	5 Extreme
Duration				
1 < 10 minutes	2 10-30 min	3 30 min – 1 hr	4 1 – 2 hrs	5 > 2 hrs
Repetition				
1 No repetition	2	3 cycle time < 30 s	4	5 cycle time < 10 s

Body part

Neck and back



Reason for analysis
This job was selected in a group participatory ergonomics session. Employees report low back and neck discomfort they associate with dozer operation. Issues regards the operation of the Dozer include the following:

- Seating comfort- some operators report discomfort in existing seats.
- Maintenance
- Poor posture on reversing

RISK CONTROLS

Design Control Options

- Replace dozer system with stackers and reclaimers
- Install a reversing camera (open areas only) to reduce occurrence of sitting with twisted spine while reversing
- Suspended cabin
- Install air ride seating- investigate available commercial options for more adjustable comfortable seating systems

Administrative Control Options

- Modify driver speed
- Increase rotation of operators within shifts i.e swap following each train load.
- Stretching programme
- Review maintenance programme for dozers

MANUAL TASKS RISK ASSESSMENT FORM

DATE & WORKPLACE

Date: 10/5/04	**Workplace:** Blackwater CHPP

TASK DESCRIPTION

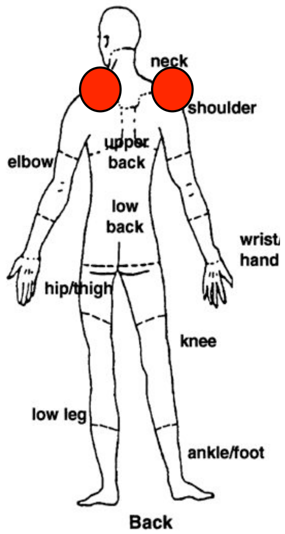
Name of task : Turning Sieve Bends

RISK ASSESSMENT

Exertion				
1 No effort	2	3 Moderate force & speed	4 ●	5 Maximum force or speed
Awkward posture				
1 All postures neutral	2	3 Moderately uncomfortable	4 ●	5 Very uncomfortable
Vibration				
1 ● None	2	3 Moderate	4	5 Extreme
Duration				
1 < 10 minutes	2 10-30 min	3 ● 30 min – 1 hr	4 1 – 2 hrs	5 > 2 hrs
Repetition				
1 ● No repetition	2	3 cycle time < 30 s	4	5 cycle time < 10 s

Body part

Shoulders and back,legs



Comments

Some groups believe this task would not be a problem if adequate maintenance was carried out on the turning mechanism. General comments related to the need for platforms to reduce the hazardous access to the sieve. Groups related that there had been adequate platforms in the past that have since deteriorated and been removed.

RISK CONTROLS

DESIGN CONTROL OPTIONS:

- Install platform around screen at ~ hip height to operator- review the existing system at Gregory Preparation plant. Consideration should be given to the access when screens are being replaced.
- Provision of portable platform/ scaffolding that can be utilised at each sieve bend.?(this idea is not supported by all crews)
- Install handles on bends for easier grip

ADMINSTRATVE CONTROL OPTIONS

- Review maintenance of Rams that control the sieve turning mechanism- when these rams are working smoothly, operators report that significantly less force is required.

MANUAL TASKS RISK ASSESSMENT FORM

DATE & WORKPLACE

Date: 24/5/03 and 31/05/04	Workplace: Blackwater CHPP

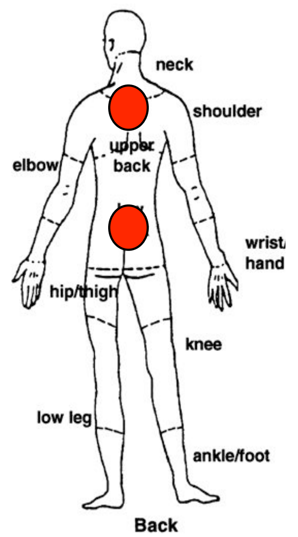
TASK DESCRIPTION: Trainloading at the Thermal Coal Plant

RISK ASSESSMENT- B Crew

Exertion				
1 No effort	2	3 Moderate force & speed	4	5 Maximum force or speed
Awkward posture				
1 All postures neutral	2	3 Moderately uncomfortable	4	5 Very uncomfortable
Vibration				
1 No	2	3 Moderate	4	5 Extreme
Duration				
1 < 10 minutes	2 10-30 min	3 30 min – 1 hr	4 1 – 2 hrs	5 > 2 hrs
Repetition				
1 No repetition	2	3 cycle time < 30 s	4	5 cycle time < 10 s

Body part

Shoulders and back



Comments

- Poor design of the workstation results in awkward postures being sustained.
- The design is committed to right hand control, however it perceived as unlikely that this could change.

RISK CONTROLS

DESIGN CONTROL OPTIONS:.

- Window extended to floor
- Replace seat with the following features; adjustable arm rests, foot rest, height and fore/aft adjustment- note: the seat should be easily adjusted from seated position
- Consider placement of all frequently used items within easy reach:
    1. Place monitors on adjustable arms at eye level
    2. Hands free 2 way
    3. Provision of work surface to left of operator at adequate height and room to place frequently used items within easy reach.

ADMINISTRATIVE CONTROL OPTIONS:

- Form a sub-committee to address all problems
- Review the design at Southern CHPP

MANUAL TASKS RISK ASSESSMENT FORM

DATE & WORKPLACE

Date:26/5/05	Workplace: Blackwater CHPP

TASK DESCRIPTION

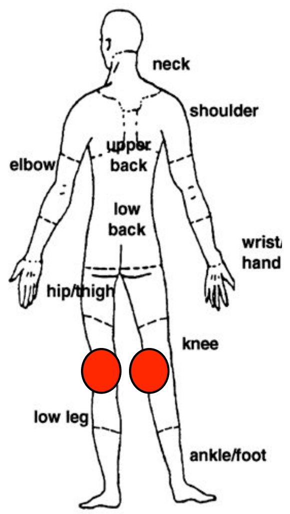
Name of task : Hosing tunnel 3

RISK ASSESSMENT-

Exertion				
1 No effort	2	3 Moderate force & speed	4	5 Maximum force or speed
Awkward posture				
1 All postures neutral	2	3 Moderately uncomfortable	4	5 Very uncomfortable
Vibration				
1 None	2	3 Moderate	4	5 Extreme
Duration				
1 < 10 minutes	2 10-30 min	3 30 min – 1 hr	4 1 – 2 hrs	5 > 2 hrs
Repetition				
1 No repetition	2	3 cycle time < 30 s	4	5 cycle time < 10 s

Body part

Shoulders and back



Back

Comments

High humidity, wet ,dark conditions.

RISK CONTROLS

***DESIGN CONTROL OPTIONS:*.**

- Eliminate source of spillage
- Articulated/ automated water canon set up under the belt
- Design tunnels with greater gradient for a better “fall
- Excavate channel systems under the belt
- Close some of the “windows”

ADMINISTRATIVE CONTROL OPTIONS:

- Maintenance on current systems: Skirts on ploughs; scrapers and rollers; water sprays
- More regular cleaning should be conducted
- Task rotation

MANUAL TASKS RISK ASSESSMENT FORM

DATE & WORKPLACE

Date:24/5/03	**Workplace:** Blackwater CHPP

TASK DESCRIPTION

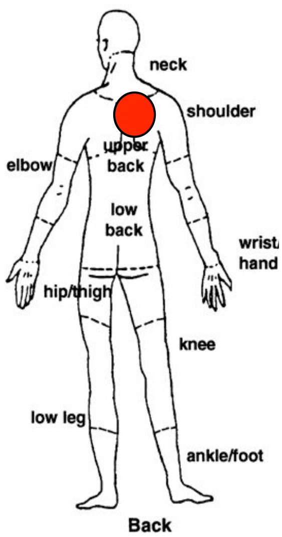
Name of task : Hosing with 2 inch hoses-Moving them around

RISK ASSESSMENT

Exertion				
1 No effort	2	3 Moderate force & speed	4	5 Maximum force or speed
Awkward posture				
1 All postures neutral	2	3 Moderately uncomfortable	4	5 Very uncomfortable
Vibration				
1 None	2	3 Moderate	4	5 Extreme
Duration				
1 < 10 minutes	2 10-30 min	3 30 min – 1 hr	4 1 – 2 hrs	5 > 2 hrs
Repetition				
1 No repetition	2	3 cycle time < 30 s	4	5 cycle time < 10 s

Body part

Shoulders and back



Comments
This is a daily activity that involves all operators. Water canons that have replaced the need to handle hoses have proved to be an excellent control, however, some large hoses remain behind.

RISK CONTROLS

DESIGN CONTROL OPTIONS:

- Install additional canons
- Design out the spillage.
- Increase available drainage holes.
- Replace all hoses that aren't on canons with 1 inch hoses
- Shorten the length of the hoses to reduce the cumbersome length that needs handling
- Review whether there are different hoses that are lighter weight and more manageable
- Install Hydraulic hose reels

ADMINISTRATIVE CONTROL OPTIONS:

- More regular cleaning to reduce the size of the task.

MANUAL TASKS RISK ASSESSMENT FORM

DATE & WORKPLACE

Date:1/ 4/05	**Workplace:** Blackwater CHPP

TASK DESCRIPTION

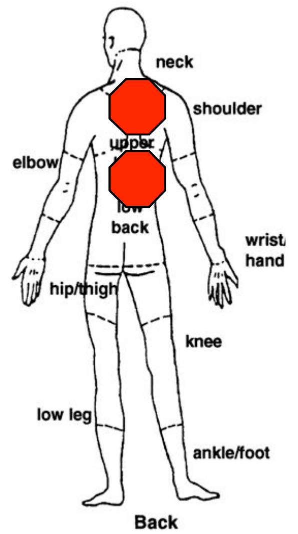
Name of task : Loading buckets in and out of coal sampling vehicle

RISK ASSESSMENT

Exertion				
1 No effort	2	3 Moderate force & speed	4	5 Maximum force or speed
Awkward posture				
1 All postures neutral	2	3 Moder uncomfortable	4	5 Very uncomfortable
Vibration				
1	2	3 Moderate	4	5 Extreme
Duration				
1 < 1 utes	2 10-30 min	3 30 min – 1 hr	4 1 – 2 hrs	5 > 2 hrs
Repetition				
1 No re on	2	3 cycle time < 30 s	4	5 cycle time < 10 s

Body part

pulling cable



Comments

This task was unanimously recognised as a manual task problem that could be easily addressed by redesign. There is a plan of the suggested design in the coal sampling lab.

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RISK CONTROLS

DESIGN CONTROL OPTIONS:

Option 1: current vehicle remains

- Move basket to side of tray to reduce awkward reach
- Cut away length of tray for smooth transition of buckets-sliding on to tray
- Design a lightweight Aluminium bar that keeps buckets in place while in transit and Has a bar along the edge that keeps buckets in tray

Option 2: Vehicle replaced with smaller tray on vehicle

- Basket is moved to along the back of tray
- Same as above

ADMINISTRATIVE CONTROL OPTIONS:

- Make several trips to reduce weight of bucket.

MANUAL TASKS RISK ASSESSMENT FORM

DATE & WORKPLACE

Date: 1/4/04	**Workplace:** Blackwater CHPP

TASK DESCRIPTION

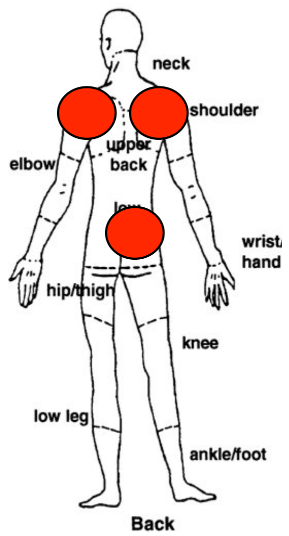
Name of task : Lifting sample bucket into hopper and then from floor in coal sampling area.

RISK ASSESSMENT

Exertion				
1 No effort	2	3 Moderate force & speed	4	5 Maximum force or speed
Awkward posture				
1 All postures neutral	2	3 Moderately uncomfortable	4	5 Very uncomfortable
Vibration				
1 None	2	3 Moderate	4	5 Extreme
Duration				
1 < [illegible] minutes	2 10-30 min	3 30 min – 1 hr	4 1 – 2 hrs	5 > 2 hrs
Repetition				
1 No repetition	2	3 cycle time < 30 s	4	5 cycle time < 10 s

Body part

Shoulders and back



Comments

The group felt that two awkward elements to this task could be reduced with a redesign of the system. The initial above shoulder height lift with a full sample bucket followed with the floor level lift are potentially manual task risk areas.

RISK CONTROLS

DESIGN CONTROL OPTIONS:.

- Combine crushing system with random sampling into one system.
- A two- levelled system where the sample vehicle reverses up to the hopper and tips the sample from the vehicle tray. The person exits the vehicle and descends to the random sample level and collects random sample from waist height bin.
- Install a system that enables the sampler to tip the bucket at waist height and pick up the bucket at the other end from above floor level.

ADMINISTRATIVE CONTROL OPTIONS:

- Review current sampling systems on the market.

South Blackwater CHPP 2004

Reducing Musculoskeletal Risk in Coal Mining

Progress

All four crews at the South Blackwater CHPP have now completed the training in manual task risk management. A total of 35 employees attended training sessions between June and early August 2004. Below is a non-ranked list of tasks that were nominated by the crews as high- risk manual tasks.

1. Shovelling coal at the P1/P2 conveyers
2. Hosing coal spillage at the loadout
3. Handling and storing hoses
4. Train loading sample point
5. Cleaning blockages in chutes and conveyers
6. Dozer access and operation
7. Changing sieve bends
8. Carrying grease cartridges and perma lube onto belts.

In addition , one employee has followed up on information learnt in training to modify the lever at the train loader. In order to open the chute to load trains the movement has been towards a sustained forearm supination (palm up). Modification to the lever will allow the operator to alternate between both forearm actions of pronation (palm down) or supination, hopefully balancing the action and reducing fatigue on one set of muscles

Following, is a summary of the tasks that have been assessed to date and the suggested control measures.

MANUAL TASKS RISK ASSESSMENT FORM

DATE & WORKPLACE

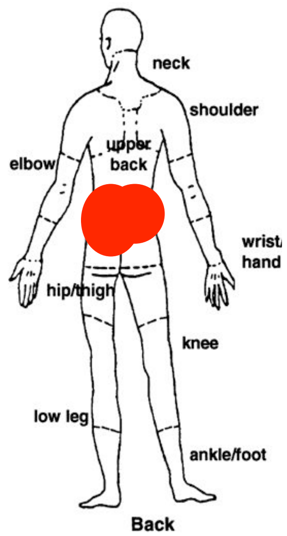
Date:17/6/04	Workplace: South Blackwater CHPP

Name of task : Shovelling Coal at the P1/P2 Conveyers

RISK ASSESSMENT

Exertion				
1 No effort	2	3 Moderate force & speed	4	5 Maximum force or speed
Awkward posture				
1 All postures neutral	2	3 Moderately uncomfortable	4	5 Very uncomfortable
Vibration				
1 None	2	3 Moderate	4	5 Extreme
Duration				
1 < 10 minutes	2 10-30 min	3 30 min – 1 hr	4 1 – 2 hrs	5 > 2 hrs
Repetition				
1 No repetition	2	3 cycle time < 30 s	4	5 time < 10 s

Body part



Shovelling at conveyers

current drainage holes

RISK CONTROLS

DESIGN CONTROL OPTIONS

- Eliminate spillage –reprogram the stacker to reduce the size of the stockpile.
- Enlarge the current drainage holes in the existing concrete structure so that coal can be hosed through without the larger lumps getting blocked.
- Introduce a small arm excavator attachment to the bobcat.

ADMINISTRATIVE CONTROL OPTIONS

- More frequent cleaning
- Increase the frequency of the employees rotating around this task within a shift.

MANUAL TASKS RISK ASSESSMENT FORM

DATE & WORKPLACE

Date:17/6/05	**Workplace:** Blackwater South CHPP

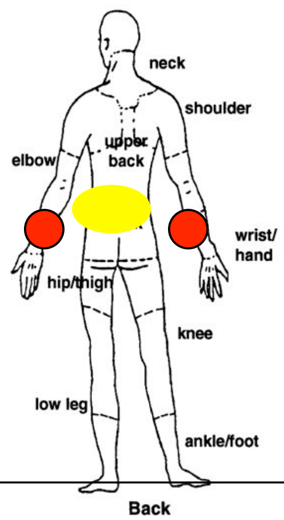
Name of task : Hosing Coal Spillage at Loadout

RISK ASSESSMENT:

Exertion				
1 No effort	2	3 Mod force & speed	4	5 Maximum force or speed
Awkward posture				
1 All postures neutral	2	3 Moderately uncomfortable	4	5 Very uncomfortable
Vibration				
1	2	3 Moderate	4	5 Extreme
Duration				
1 < 10 minutes	2 10-30 min	3 30 min – 1 hr	4 1 – 2 hrs	5 > 2 hrs
Repetition				
1 No repetition	2	3 cycle time < 30 s	4	5 cycle time < 10 s

Body part

forarm/wrists and back



RISK CONTROLS

Design Control Options

- Enlarge pit under the rail line
- Remove some of the concrete wall and extend pit
- Install 1-2 articulated water canons that can be adjusted to reach most of the area
- Maintain second hose with smaller diameter
- Install a bank of sprays/jets to remain on while the train is loading
- Can any concrete sleepers be removed to make cleaning easier?

Administrative Control Options

- Maintain task rotation on large spills

MANUAL TASKS RISK ASSESSMENT FORM

DATE & WORKPLACE

Date: 21/6/05	**Workplace:** Blackwater CHPP

TASK DESCRIPTION

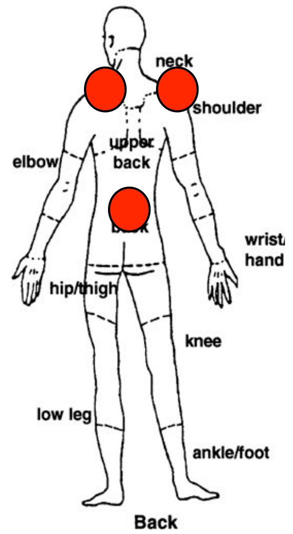
Name of task : Jack Hammering blockages in conveyer and chutes

RISK ASSESSMENT

Exertion				
1 No effort	2	3 Moderate force & speed	4 ●	5 Maximum force or speed
Awkward posture				
1 All postures neutral	2	3 Moderately uncomfortable	4 ●	5 Very uncomfortable
Vibration				
1 None	2	3 Moderate	4 ●	5 Extreme
Duration				
1 < 10 minutes	2 10-30 min	3 30 min – 1 hr	4 1 – 2 hrs	5 ● > 2 hrs
Repetition				
1 No repetition	2 ●	3 cycle time < 30 s	4	5 cycle time < 10 s

Body part

Shoulders and back,legs



Comments
This is a universally unpopular task. Employees advise pinch and strain injuries have already occurred carrying out this task. It is felt that the risk of a significant back or shoulder injury is high.

RISK CONTROLS

DESIGN CONTROL OPTIONS:

- Improve ripping and blasting of coal
- Install a mobile portable crusher
- Install a railway grid or grizzly over stock pile feeder
- Use of explosives in chute
- Install a rock breaker/ sizer at head of chute
- Design an extension arm for the jack hammer at head of chute

ADMINSTRATVE CONTROL OPTIONS

- Rotate this task around crew

MANUAL TASKS RISK ASSESSMENT FORM

DATE & WORKPLACE

Date: 16/7/04	Workplace: Blackwater South CHPP

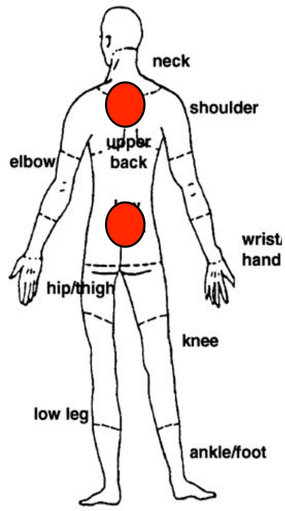
TASK DESCRIPTION: Handling Hoses- storage and moving

RISK ASSESSMENT

Exertion				
1 No effort	2	3 Moderate force & speed	4	5 Maximum force or speed
Awkward posture				
1 All postures neutral	2	3 Moderately uncomfortable	4	5 Very uncomfortable
Vibration				
1 None	2	3 Moderate	4	5 Extreme
Duration				
1 < 10 minutes	2 10-30 min	3 30 min – 1 hr	4 1 – 2 hrs	5 > 2 hrs
Repetition				
1 No repetition	2	3 cycle time < 30 s	4	5 cycle time < 10 s

Body part

Shoulders and back



Back

Comments
Employees identify having experienced minor back and shoulder strains. Current practice requires them to neatly hook hoses on existing brackets around the plant. Some hoses are rolled on the ground. It is reported that the hoses are difficult to roll up and when stored, become kinked and less manageable. Housekeeping becomes poor and the hoses are left in a variety of conditions.

Example of hose station as seen at the North Prep Plant

RISK CONTROLS

DESIGN CONTROL OPTIONS:.

- Review spill points and consider options to reduce or eliminate spillage
- Consider the hose diameters- a smaller hose may be more manageable but may compromise efficiency-it is felt the one and half inch hoses are adequate
- Install additional water outlets in conjunction with reducing length of hoses- this will remove the need for the hose couplings (catches on surfaces)
- Review available hose fittings with lower profile and less likely to catch on surfaces- or "bandit" strapping at end of hose so as it doesn't catch.
- The "newer" rubber hoses have more friction and make moving them around more difficult- ensure the hoses are of the same older style "yellow"
- Consider installing water canons in "high" spill areas.

ADMINISTRATIVE CONTROL OPTIONS:

- Review supply system- hoses meant for South Plant are acquired by other areas of the operation prior to them being collected?
- Review storage technique-remove existing brackets and where practical hoses are kicked to the side of walk-ways, etc, otherwise hoses should be placed in a figure of eight.

MANUAL TASKS RISK ASSESSMENT FORM

DATE & WORKPLACE

Date: 22/6/04	Workplace: Blackwater South CHPP

TASK DESCRIPTION

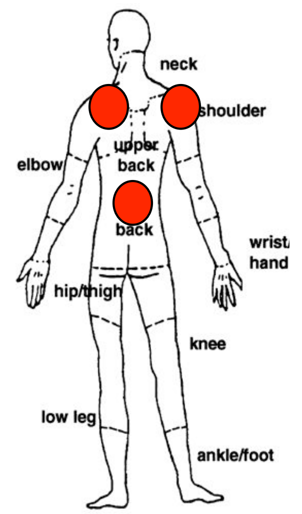
Name of task : Collecting Load out sample

RISK ASSESSMENT-

Exertion				
1 No effort	2	3 Moderate force & speed	4	5 Maximum force or speed
Awkward posture				
1 All postures neutral	2	3 Moderately uncomfortable	4	5 Very uncomfortable
Vibration				
1 None	2	3 Moderate	4	5 Extreme
Duration				
1 < 10 minutes	2 10-30 min	3 30 min – 1 hr	4 1 – 2 hrs	5 > 2 hrs
Repetition				
1 No repetition	2	3 cycle time < 30 s	4	5 cycle time < 10 s

Body part

Shoulders and back



Comments

The sample points are many and varied. In some areas the collection points are poorly designed and require poor body mechanics to handle sample. The "load Out" sample point is an example of one such area. Employees advise low back pain is not uncommon amongst the sampling group.

Load Out sample point

RISK CONTROLS

DESIGN CONTROL OPTIONS:.

There have been a variety of suggestions for this task. The 2 differing concepts depend on the access to the point:

- If the existing problems with the chute are repaired the size of the sample can be reduced in half, a roller frame at correct height to the truck tray could be installed and a smaller sample more easily slid over onto the truck tray.
- Elevate the sample point to enable the truck to back under the point. The bucket can be set under the sample chute and either a tilting or other mechanism to fill bucket with sample. It would be important the sample size be split into 2 buckets as handling the sample on the return to the lab is also potentially a problem. This approach does involve the sampler accessing the tray of the truck- it should be checked that the truck has steps to access the tray. (access is introducing another risk to be managed) Also, ensure the sample is stored at the back of the truck near the tailgate.

Both concepts involve the placement of a "lip" on the ground to specify the correct backing point and also provide a safety barrier to possible rolling of the truck back onto the sampler.

ADMINISTRATIVE CONTROL OPTIONS:

- Manual handling training.

Blackwater CHPP (Maintenance) 2004

Four crews at the Blackwater CHPP have been involved in training in manual tasks risk identification and control. Three employees involved in Coal Sampling have also participated in training. As a result of positive feedback from the operator's training, the maintenance department requested sessions for their workforce. Subsequently two sessions have been delivered ,with attendance of twelve people. There was a mix of contractor and permanent employees.

Below is a list of tasks that have been identified by the maintenance crews as manual task areas of concern.

1. Replacing cyclone pump
2. Replacing brushes on the dragline
3. Changing return rollers on conveyer 8
4. Accessing screens in maintenance days
5. changing "grizzly" bars
6. Loading oxy Bottle on and off vehicles
7. "Y' piece on tell tale screen

While onsite talking with staff and reviewing tasks, advice was also provided to an employee who spends some time at a computer, regards workstation ergonomics.
Given the maintenance group was small, controls for only two of the items were considered. (4 and 6).

Following, is a summary of the task that have been assessed and the suggested control measures.

DATE & WORKPLACE

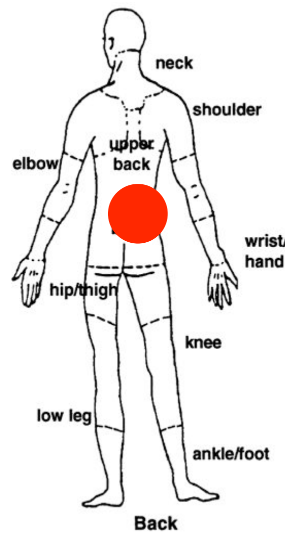
Date:28/7/04	Workplace: Blackwater CHPP Maintenance crew

Name of task : Lifting Oxy bottles in and out of Vehicle

RISK ASSESSMENT

Exertion				
1 No effort	2	3 Moderate force & speed	4	5 Maximum force or speed
Awkward posture				
1 All postures neutral	2	3 Moder uncomfortable	4	5 Very uncomfortable
Vibration				
1 Non	2	3 Moderate	4	5 Extreme
Duration				
1 < minutes	2 10-30 min	3 30 min – 1 hr	4 1 – 2 hrs	5 > 2 hrs
Repetition				
1 N repetition	2	3 cycle time < 30 s	4	5 cycle time < 10 s

Body part



Comments

This task is carried out by all staff 3-4 times each day. The weight of the large oxy bottles is 50kg..

RISK CONTROLS

DESIGN CONTROL OPTIONS

- Maintenance of reticulation systems in plant- this eliminates most of the need to carry oxy bottles in and out of plant
- Purpose built trolley that lifts to height of vehicle
- Use of crane
- Storage in racks at same height of the ute.
- Use smaller oxy bottles if sufficient for job requirement.

ADMINISTRATIVE CONTROL OPTIONS

- Training for forklift and hiab
- Training in correct lifting procedures
- Ensure supply of small full bottles are maintained.

MANUAL TASKS RISK ASSESSMENT FORM

DATE & WORKPLACE

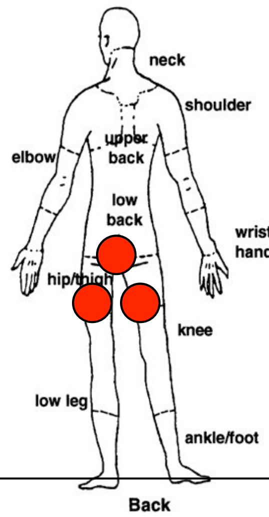
Date:11/8/04	**Workplace:** Blackwater CHPP Maintenance

Name of task : Access in and out of screens for Lubrication

RISK ASSESSMENT:

Exertion				
1 No effort	2	3 Moderate force & speed	4 ●	5 Maximum force or speed
Awkward posture				
1 All postures neutral	2	3 Moderately uncomfortable	4 ●	5 Very uncomfortable
Vibration				
1 ●	2	3 Moderate	4	5 Extreme
Duration				
1 < ● minutes	2 10-30 min	3 30 min – 1 hr	4 1 – 2 hrs	5 > 2 hrs
Repetition				
1 No repetition	2 ●	3 cycle time < 30 s	4	5 cycle time < 10 s

Body part



Reason for analysis
There are 2 floors in the plant with 20 screens on each floor. The lubrication may require up to 26 screens being accessed in and out in one day. The employees may be required to use, shifters, stilsons, grease-guns and 20l drums of oil. These items have to also be lifted in and out of each screen.
Employees report symptoms of fatigue and strain in the legs and low back following this maintenance day. (every 5-6 weeks).
The screens face each other back to back and employees are required to climb in and out of each one rather than step over the chute that exists between each screen.

Simulating screen access (low height outside) *Typical height of screen*

RISK CONTROLS

Design Control Options

- Design of mobile lightweight step platform that can be hooked onto screen over the chute section for ease of access and added benefit of safely stepping across the chute.
  (it is understood this may not be useable on all screens, because of reduced space, but particularly the top floor of the plant)
- Additional steps and grab rails be built into screens to reduce extreme hip angles
- Install a monorail over the top of the screens with oil hooked to it to eliminate need to lift drums in and out
- Reduce size of oil drums or half fill them to reduce handling
- Install 60l oil onto mobile step trolley that can be wheeled around top floor.

Administrative Control Options

- Use crane to bring a larger unit of oil into the plant and pump oil into smaller more manageable units.
- Review SOP for screen access as some employees are shortcutting across the chute.

Tasks identified as requiring control measures at United:

Development Crew

- Bolting on the 12CM12 continuous miner. The miner is designed to be used in a 'cut and flit' process rather than bolting the roof and ribs directly from the miner itself, as is currently the done.
- Roof bolting with 4 m Tens cables.
- Handling the miner cable.
- Bolting the ribs with the wasp.
- Installing roof mesh.
- Handling roof mesh; from pit top to the face.
- Installing vent tubes.
- Bolting with the Fletcher bolter.
- Installation of the conveyor belt (100m approx) each week.
- Overhead pipe extension.
- Cable extension during panel advance and installing HT Plugs.
- Installing Bat bags.
- Servicing the machinery. (E.g. fill the oil on the miner and carrying drums).
- Breaking up the coal on the grizzly.
- Driving the shuttle car.
- Driving the LHD.
- Driving the MPV.
- Driving the Eimco.
- Installing the belt onto the LTU.
- Shortening sections of the belt after each push of the long wall.

Long Wall Crew

- Shortening and removing the belt structure.
- Removal / dismantling the monorail.
- Checking the AFC and BSL chain.
- Moving the chock legs on and of the face.
- Recovering the bat bags.
- Moving the D/A ram on the face.
- Moving gear (e.g. 20 L oil drum) along the face.
- Carrying PPE (E.g. self rescuer on the belt).
- Jack hammering and bolting on the face.
- Changing the shearer cable.
- Canton dusting.
- Dragging gear down the belt road to the main-gate (e.g. DA rams, Chocks, etc).

Out Bye Crew

- Belt roller change out.
- Lifting pumps.
- Pump change out.
- Handling mesh in the development panel.
- Moving chock legs.

- Installing double vent machine access doors.
- Installing the Bulka bag in the return.
- Erecting bag in the tail gate.
- Carrying 20 L drums of oil or coolant.
- Cable handling.
- Installing H/T plugs.
- Belt move.
- Installing high Tens cables and Mega bolts.
- Access / egress machines.
- Driving MPV, LHD and loaders.

PErforM

Participative Ergonomics for Manual Tasks

MANUAL TASKS RISK ASSISSMENT FORM

DATE & WORKPLACE

Date: 17/11/04	**Workplace:** United Colliery

RISK ASSESSORS

Work Unit / Team: Long-wall Crew (Day, Afternoon and Night Shifts).

Positions: Long-wall miners and tradesmen.

Names: Day, Afternoon and Night Shifts Long-wall Crews, Steve Nash and Gary Dennis

TASK DESCRIPTION

Name of Task: Dismantling and removing the monorail.

Why was this task selected: Two sections of the monorail are removed after each dual pass of the shearer on the face (approx. 3 per man per shift). Not only is it a routinely performed task but removing each monorail rail section (34 kg) involves both large forces and awkward postures. Furthermore, this task has been previously identified as incurring significant musculoskeletal risks but currently remains an unresolved issue.

Location where task occurs: Long-wall belt road (BSL).

Who performs the task: This task is commonly performed by the main gate operator and/or other members of the long-wall crew. Although this task has been mandated by management as a two-man job, it is occasionally performed by a single crew member.

General description: Once the temporary chain is attached under the monorail at the in-bye end of the rail, the locking pin between the rails is knocked out using a claw hammer. Both rails are then lifted (often arms over head) and the suspension chains are removed. Next the temporary chain is removed and the rails are levered apart and the in-bye rail is dropped / lowered manually by the miner. Finally, the in-bye bracket and nut is removed before carrying the rail to the out-bye cut trough and placed into the storage bucket. Note: slight variations in this procedure occur between the miners and the different crews.

Postures: Awkward postures of the back and shoulders occur; when leaning backwards over the rail to remove the locking pin and chains and when lifting and lowering the rails. In particular hyperextension and twisting of the spine and overhead reaching postures are currently required to perform the task as the platform is not directly under the monorail.

Forceful / muscular exertions: Large muscular exertions are required to hammer out the locking pin and to lift, lower and carry the heavy (34 kg) rail sections.

Repetition and duration: The removal of each section takes approximately 10 min and each miner performing this task would typically remove 3 – 4 rail sections per shift,

Tools or equipment used: Claw hammer, pin punch, temporary chain and rail sections (34 kg and 2 m long).

Work / task organisation and environment: Conditions that make this task awkward include: variations in the height and alignment of the platform with the monorail and the poor floor conditions whilst carrying the rail section up to 100 m along the belt road back to the storage bucket.

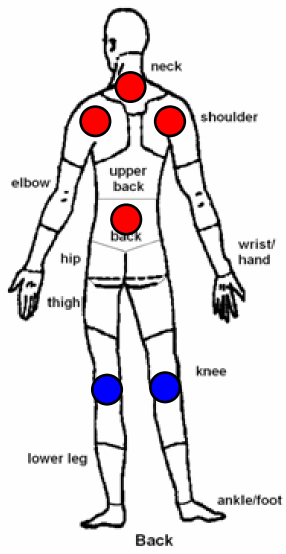
Date: 17/11/04	**Workplace:** United Colliery

Name of task: Dismantling the monorail

RISK ASSESSMENT

Exertion				
1 No effort	2	3 🔵 Moderate force & speed	4	5 🔴 Maximum force or speed
Awkward posture				
1 All postures neutral	2	3 Moderately uncomfortable	4 🔵	5 🔴 Very uncomfortable
Vibration				
1 🔵 None	2 🔴	3 Moderate	4	5 Extreme
Duration				
1 🔵🔴 < 10 minutes	2 10 – 30 min	3 30 min – 1 hr	4 1 – 2 hrs	5 > 2 hrs
Repetition				
1 🔵🔴 No repetition	2	3 cycle time < 30 s	4	5 cycle time < 10 s

Body part



COMMENTS

Dismantling the monorail is a task that is routinely performed by members of the long-wall crew as sections of the long-wall are mined be the shearer. The primary concerns raised by each of the three crews who analysed this task in the workshop were; the large forces required to perform the task due to the heavy nature of the rails, the awkward postures required as the platform is almost always not positioned under the monorail, and finally the unresolved issue of carrying the rails up to 100 m to the out-bye Cut-through instead of having a bucket which is more conveniently located.

RISK CONTROLS

DESIGN CONTROL OPTIONS:

- Make the platform hydraulically adjustable both in and out and up and down. Being able to vary the position of the platform under the monorail will significantly reduce the awkward postures involved in the task (e.g. spinal twisting and hyperextension), whilst varying the vertical position of the platform will cater for the varying standing heights of the miners and reduce stress on the shoulder by minimizing the overhead work performed by the arms. In addition, the hydraulic platform could also be used to raise the rails up whilst removing the chains via a lifting ram with a roller on top that couples to the underside of the rail and is attached to the edge of the platform. However, the new risks associated with this addition to the platform would have to be assessed.
- The platform at the in-bye end could be extended to enable the rails to be removed after the 2nd main gate push. This would reduce the time constraints placed on the miners to remove the first rail between the 1st and 2nd pushes, as currently the platform would not be in place to remove the first rail after the 2nd push.
- A long crowbar with a hook could be used to raise the monorail to remove the chains and lower the rail once the chains are removed, thus reducing the force required to lift and lower the rails. This technique has been dubbed the "Naz Lift" after the miner Naz who came up with the idea.
- Look into purchasing a new locking pin design (e.g. a split pin) that doesn't require a forceful blow by a hammer to remove the pin.
- If the current pins are retained a hammer with a longer handle would reduce the force required to remove the pin and also reduce the incidences of the hands being pinched against the rails.
- Look into the possibility of reducing the weight of the rails by drilling holes in them or alternately purchasing lighter weight rails.
- Look into the cost associated with leaving the monorail versus the costs associated with injury associated with its removal.
- Build a monorail cassette storage bin that travels along the out-bye end of the monorail so that each rail section doesn't have to be carried back to the C/T. Note: this cassette will have to carry at least 50 rails, and a full design was developed in the workshop session.

ADMINISTRATIVE CONTROL OPTIONS:

- Training for those involved in moving the storage pods for the rails should conducted to reduce unnecessary distance that the rails have to be carried. The pods should only be moved just before the damn construction.
- The dismantling of the monorail task should always be conducted by at least two crew members, and appropriate staffing and work practices should allow for this.

ADDITIONAL INFORMATION

The platform attached to the main gate was fitted with hydraulics to extend it up and down and in and out. This proved very effective, however, the hydraulics moving the platform up and down were too small and thus slow. Currently, these hydraulics are being replaced by Hedweld Engineering Pty Ltd (Singleton).

Figure 1: Removing a monorail section from the platform attached to the maingate.

Figure 2: Monorail platform refurbishment at Hedweld Engineering workshop.

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Participative Ergonomics for Manual Tasks

MANUAL TASKS RISK ASSESSMENT FORM

DATE & WORKPLACE

Date: 4/11/04	**Workplace:** United Colliery (Singleton)

RISK ASSESSORS

Work Unit / Team: Development Crew (Day, Afternoon and Night Shifts).

Positions: Development miners and electrician tradesmen.

Names: Day, afternoon and night shift development crews, Steve Nash and Gary Dennis

TASK DESCRIPTION

Name of Task: Roof bolting on the continuous miner with 7-foot roof bolts.

Why was this task selected: Roof bolting is one of the primary tasks of the development crew, which makes up 60 – 70% of the total work time for the two man crew on the miner. It is a repetitive task (approx 50 bolts per man per shift) that involves awkward postures and can be physically demanding, particularly on the back, shoulders and forearms.

Location where task occurs: Development panel.

Who performs the task: A two-man face crew performs the task, one of which is also the miner driver. These two miners perform the task for the duration of the 8-hour shift except during crib, when they are relieved for up to an hour.

General description: Two bolts are usually manually carried from the pod at the rear of the miner and placed pointing up in front of the drill rig. A 7-foot drill steel is placed into the drill rig and used to drill into the roof. Once the hole is drilled the steel is removed a dolly is inserted into the bottom of the rig and a 7-foot bolt (7kg) is place into the dolly along with a face plate and the jaws on the top of the rig are closed around the bolt. A chemical agent (in a tube) is fed up into the hold and is pushed up via the bolt. The roof mesh is then set in place before the bolt is screwed and set into place.

Postures: Awkward postures of the back, shoulders and forearms occur; when bent over due to low seams, reaching around the drill rig to insert / remove rods or drill steals (particularly for the inside bolt) and when reaching overhead to insert and fed the chemical into the hole.

Forceful / muscular exertions: Large muscular exertions are required by the muscles of the back, shoulder and forearm when handling the bolt, and are also often required when the mesh becomes caught on protruding objects. Additional effort is required when moving and storing the box of chemicals and the plate sets on the miner.

Repetition and duration: Each crew member bolts 30 – 50 bolts over an 8-hout shift.

Tools or equipment used: Continuous miner, 7-foot bolts (7 kg), 7-foot drill steels, plates, chemicals and roof mesh (5 m x 1.2 m).

Work / task organisation and environment: Conditions that make this task awkward include: a low seam height, uneven and muddy floor conditions, low roof obstacles (e.g. bolt tails), protruding objects on the miner which catch the roof mesh and the confined space of the miner's platform due to the wide throat of the miner.

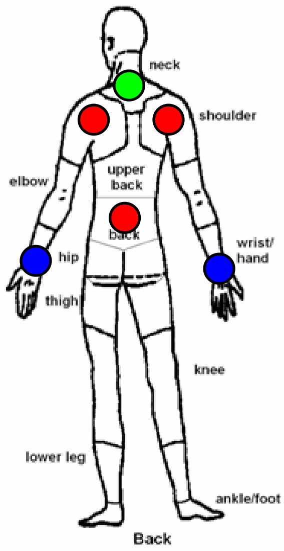
Date: 4/11/04	**Workplace:** United Colliery (Singleton)

Name of task : Roof bolting on the continuous miner with 7 foot bolts.

RISK ASSESSMENT

Exertion				
1 No effort	2	3 Moderate force & speed	4	5 Maximum force or speed
Awkward posture				
1 All postures neutral	2	3 Moderately uncomfortable	4	5 Very uncomfortable
Vibration				
1 None	2	3 Moderate	4	5 Extreme
Duration				
1 < 10 minutes	2 10 – 30 min	3 30 min – 1 hr	4 1 – 2 hrs	5 > 2 hrs
Repetition				
1 No repetition	2	3 cycle time < 30 s	4	5 cycle time < 10 s

Body part



COMMENTS

This is the primary task performed by the development crews, taking up to 60 – 70% of the shift for those miners on the continuous miner. Bolting involves a lot of strain on the back, shoulders and forearms when lifting the rods and drill steals into the drill rig. In addition, bolting involves a lot of repetition (50 rods per shift) and many awkward postures. As a result, all three development crews identified roof bolting as the number one task in need of an appropriate intervention to reduce musculoskeletal injury risks.

RISK CONTROLS

DESIGN CONTROL OPTIONS:

- Make the platform height adjustable so that particularly tall miners can stand upright whilst drilling and do not have the risk of hitting their heads on the exposed rods tails in the roof. In addition, the tails of the exposed rods can be trimmed via a hydraulic cutter (i.e. “the jaws of life”).
- Install / extend the platform near the drill rig so that the miners can get closer to the rig, which will reduce the need to extend the arm whilst inserting the rods, steels and dollies. This extended platform section should be designed so that it is attached to the bottom of the rig and so it moves as the rig is moved in and out for the inside and outside bolts.
- Lower the height of the drill motor so that the rods are easier to place in the dolly.
- Redesign the dolly (i.e. chuck) so that it fits both the rods and drill steels, thus the dolly doesn’t have to be continually changed.
- Purchase a new miner with a smaller throat (e.g. 12CM30), which can better accommodate the drill rigs and as a result reduce the awkward postures involved with the current position of the drill rigs.
- Look into new automated bolting technology, which is currently being trialed at Crinum. These bolts automatically drill, and are fixed in with cement which is contained within the bolt.
- Look into the placement of mesh sheets (15 – 30) on-top of the miner so that the miners don’t have to walk them over head from their storage place along the ribs.
- Look into smaller diameter vent tubes that would provide more room on that side of the miner.
- Look into extending the mesh sliders and / or cross beams on the sliders to aid in the movement of the mesh across the miner.
- Reduce the materials that the mesh can get caught on e.g. head-lights, loose materials in the storage bins, etc.
- Build specific stage bins for the chemicals and plates that are also positioned closer to the drill rig if possible.
- Purchase / order the chemicals with a lower number of tubes (10 – 15) per box.

ADMINISTRATIVE CONTROL OPTIONS:

- Extra man on the continuous miner to help with job rotation and moving mesh.
- Train more miner operators to allow for job rotation.
- Ensure the replacement of crew members who are sick on a shift to ensure that it doesn’t place extra stress on the rest of the crew, and allows for job rotation.
- Train all operators about the correct storage of the equipment on the miner (i.e. improved housekeeping) so that the mesh is less likely to get caught whilst being moved across the miner.

PErforM

Participative Ergonomics for Manual Tasks

MANUAL TASKS RISK ASSISSMENT FORM

DATE & WORKPLACE

Date: 24/8/2005	**Workplace:** United Colliery

RISK ASSESSORS

Work Unit / Team: Safety Committee

Positions: Miners and management

Names: Bob Bell, Jim Johnson, Shane Pease, Alaine Callen and Gary Dennis

TASK DESCRIPTION

Name of Task: Changing DA (Direct Access) Rams on the Longwall

Why was this task selected: This task has been identified as a major cause of musculoskeletal injury, with numerous incidences reported. This task is performed only a few times per month but is very strenuous.

Location where task occurs: Longwall

Who performs the task: Miners on the longwall.

General description: Whenever a DA Ram is damaged the ram needs to be changed.

Removal procedure: Leave supports one web back with cantilevers extended (Ram is fully compacted), isolate hydraulics (& pressure) and electrics, clean (hose) walkway and cover, remove cover, remove rear pin retention bars and front keepers, disconnect hoses, fit sling and use chain blocks to lift ram out of the support and transfer across to the AFC, lift over the boot-end using the Hiab and position into custom brackets.

Install procedure: Use Hiab to position new ram on AFC and transport to chock site, use chain blocks to lift new ram into position, fit rear pin and hydraulics, fit front keepers and lower cover plate.

Postures: The environment is quite restricted and the ram is at floor level, both of which combine to require miners to bend over at the waist and rotate whilst moving the cover plate, fitting the retaining pins and keepers and removing and positioning the ram. This places the back and the shoulders at an increased risk of MSD.

Forceful / muscular exertions: The DA Ram weighs approximately 150 kg. A lot of force is required to push the ram into position in the far support.

Repetition and duration: A number (1 – 4) DA Rams are changed a few (2 to 3) times per month. The replacement time takes approximately 2 hrs.

Tools or equipment used: 2 ¾ Ton chain blocks, Heel bar, shifter, 2 x 13 mm hose caps, 3 10 mm hose caps, 2 x 1m fibre slings, Hiab.

Work / task organisation and environment: Limited space and poor lighting. Previously, recycled rams had a hollow core which resulted in more rams changes, however, now when they are sent away for maintenance the newly installed ram has a solid core, which is more durable. Approximately 100 rams still have the hollow core, with the solid core rams costing $6,800.

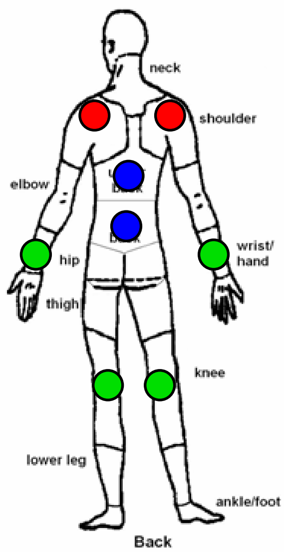
Date: 24/8/05	

Name of task : Changing DA Rams

RISK ASSESSMENT

Exertion				
1 No effort	2	3 Moderate force & speed	4	5 Maximum force or speed
Awkward posture				
1 All postures neutral	2	3 Moderately uncomfortable	4	5 Very uncomfortable
Vibration				
1 None	2	3 Moderate	4	5 Extreme
Duration				
1 < 10 minutes	2 10 – 30 min	3 30 min – 1 hr	4 1 – 2 hrs	5 > 2 hrs
Repetition				
1 No repetition	2	3 cycle time < 30 s	4	5 cycle time < 10 s

Body part



COMMENTS

While the DA-Rams are changed only periodically whenever faults are detected, the task of changing them is particularly strenuous and numerous MSD injuries have been reported. Most injuries seem to occur whilst repositioning the ram back into the keepers. It was noted that miners who are experienced at changing the rams are at reduced risk, because they sling the ram in such a manner (slings balancing the ram relative to the centre of gravity) as to allow it to slide more easily into position, those miners without such experience are more likely to use brute force whilst bent over to position the new ram.

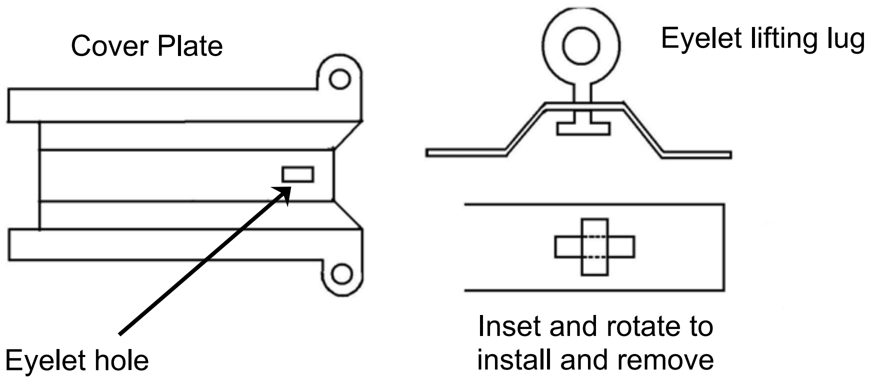
As a priority control measures should focus on:

- Reducing the need for brute force and stooped over postures whilst positioning the new ram into position.
- Reducing the muscular force required by the shoulders and back.

RISK CONTROLS

DESIGN CONTROL OPTIONS:

- Place a lug on the outside casing of the DA-Ram which is positioned at the centre of gravity (CoG) when the ram is fully collapsed. A clip rather than the web sling can then be used to lift and lower the ram, which would enable easier attachment to the CoG and speed up the task so that less time was spent in awkward postures. A secondary lug could also be fitted at a position away from the CoG that allowed the ram to be angled and slide more easily into place. However, these lugs could only be installed on rams that have been removed from underground whilst being fixed. As they are refitted with solid cores it is less likely that they will have to be replaced in the future.
- An alternative to installing lugs on the DA-Rams would be to paint a stripe on the outside casing to identify the CoG and the position where the new ram is best balanced when sliding it back into position (Figure 1).
- The canopy roof lugs are currently off-set so that the ram is not centred. If these lugs were evenly positioned then the ram could be more evenly centred, which can reduce the need for forceful exertions. However, these lugs could only be installed on the surface.
- With a small cut in the ram cover (Figures 2 & 3) an eyelet could be made to lock into this cut and then could be used to lift the cover mechanically, reducing the force and awkward postured required to move the cover. (see schematic below).



ADMINISTRATIVE CONTROL OPTIONS:

- Some miners are very experienced at changing the DA-Rams. The biggest benefit being that they position the lifting slings in such a manner as to allow the new ram to slide more easily into position, which removes the MSD risks associated with the force and awkward postures used by less experienced miners. Thus, a competency level could be required to change the DA-Rams, involving training on the correct positioning of the sling on the ram and the techniques involved.
- The provision of knee pads may help miners whilst kneeling when installing and removing the ram.

FIGURES

Figure 1: The DA-Rams have had a line painted on them to indicate the best strapping point.

Figure 2: DA-Ram cover plate

Figure 3: Position of the DA-Ram (arrow) on the longwall roof support

PErforM

Participative Ergonomics for Manual Tasks

MANUAL TASKS RISK ASSISSMENT FORM

DATE & WORKPLACE

Date: 20/7/2005	**Workplace:** United Colliery

RISK ASSESSORS

Work Unit / Team: Safety Committee

Positions: Miners and management

Names: Darren George, Troy Guthrie, Barry Hungerford, Michael Niven, Darren Robertson, Jerry Wallace and Gary Dennis.

TASK DESCRIPTION

Name of Task: Rib Bolting with the WASP

Why was this task selected: The task has been identified as a major cause of musculoskeletal injury, with numerous incidences reported. This task makes up a major component of the development miners shift and involves awkward postures and large forces.

Location where task occurs: Development panel

Who performs the task: Development miners on the continuous miner.

General description: Whenever rib conditions are poor the WASP (hand held bolter, see Figure 1) is used to bolt steal or flexible mesh to the ribs. Steel mesh has two rows of bolts while the flexible mesh requires three rows of bolts (Figures 2 & 3). Due to the cramped conditions on the CM platform a two-foot drill steal is used to drill an initial hole with the WASP before a four-foot drill steal is used. After drilling, the mesh is bolted to the ribs with four-foot bolts (either fibreglass or steel), often knocked in with a sledge hammer. The top bolts for the flexible mesh are approximately 350mm from the roof, while for the steel mesh they are lower.

Postures: Bolting the top bolts requires a lot of strenuous overhead shoulder work (with notable MSD risk), while the lower bolts can involve a semi-stooped posture. Major postural problems also occur due to, the confined space along side the wide throat LMC12 miner and the lack of standing room, particularly during the installation of the top bolt at the front of the miner.

Forceful / muscular exertions: The WASP weighs 9.8 kg plus the weight associated with the attached hose and the bolts range from 1-2 kg (fibreglass) to 4 kg (steel). Major muscular exertion is required by the wrist to hold the WASP when the drill steel is attached (CoG issue), and by the shoulders and back during drilling which can require considerable force.

Repetition and duration: Miners work on the continuous miner bolting for the entire duration of the shift (8.5 hrs), often on one side of the miner. It is a primary task performed 'day-in-and day-out' by miners in the development panel.

Tools or equipment used: WASP, 9.8 kg plus the cable (see attached figure). Drill steels, two-foot (2 kg) and 4-foot (4 kg). Bolts and plates. Sledge hammer.

Work / task organisation and environment: The limited space and small width of the platform place additional stress on the miners. Also the correct length and type of drill steels and the aggressive drill tips are not always available, making drilling more strenuous.

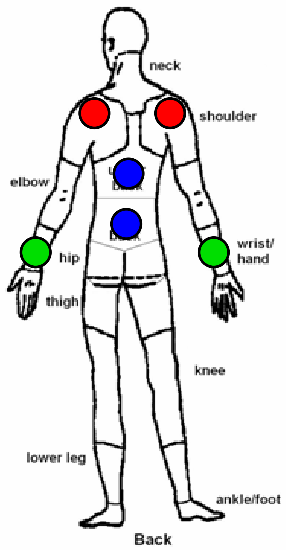
Date: 20/7/05	

Name of task : WASP Rib bolting

RISK ASSESSMENT

Exertion				
1 No effort	2	3 Moderate force & speed	4	5 Maximum force or speed
Awkward posture				
1 All postures neutral	2	3 Moderately uncomfortable	4	5 Very uncomfortable
Vibration				
1 None	2	3 Moderate	4	5 Extreme
Duration				
1 < 10 minutes	2 10 – 30 min	3 30 min – 1 hr	4 1 – 2 hrs	5 > 2 hrs
Repetition				
1 No repetition	2	3 cycle time < 30 s	4	5 cycle time < 10 s

Body part



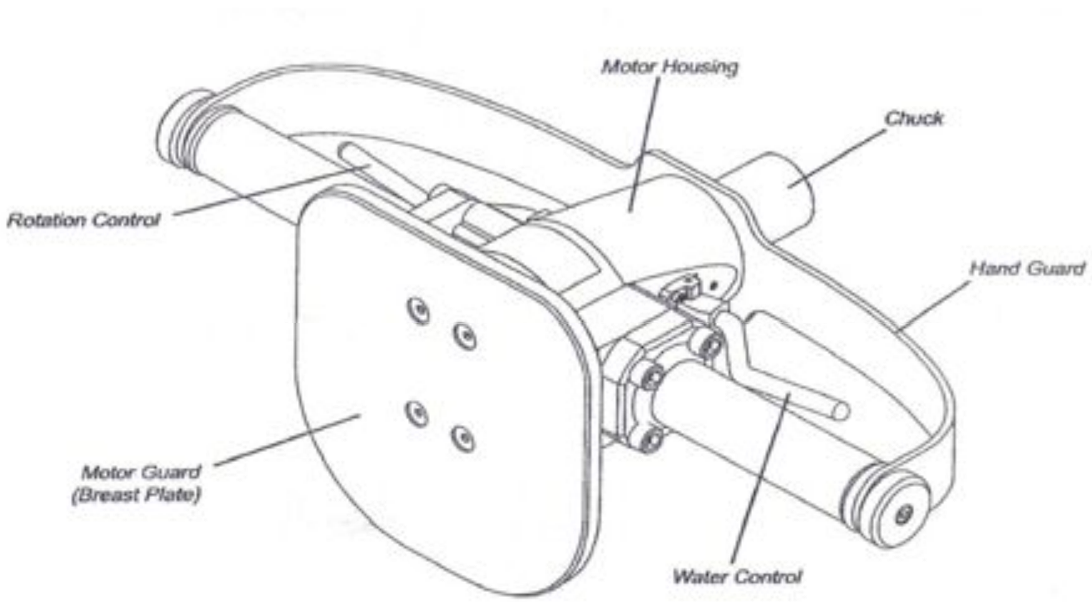
COMMENTS

While rib bolting is not always necessary, when it is required (due to rib conditions) bolting with the WASP becomes a task that is performed throughout the duration of the 8.5 hr shift. The major risk of MSD while using the WASP is to the shoulders, back and forearms, as highlighted by the PErforM risk assessment tool above. The risk of MSD to the shoulders is primarily due to the awkward overhead drilling posture required whilst drilling the top bolt at the front of the miner (see Figures 2 &3). In this overhead position the capacity of the upper body to produce horizontal force is reduced and thus the load placed on the muscles of the shoulders and upper back are increased (approaching a maximum). The muscles of the wrist are also required to produce large forces for extended durations to counteract the tendency of the WASP with a drill inserted to rotate downwards (note the horizontal handle position Figure 1) due to the forward position of the centre of gravity (CoG). Added to the strain on the wrist is the localised vibration experienced by the hand, which can decrease grip strength.

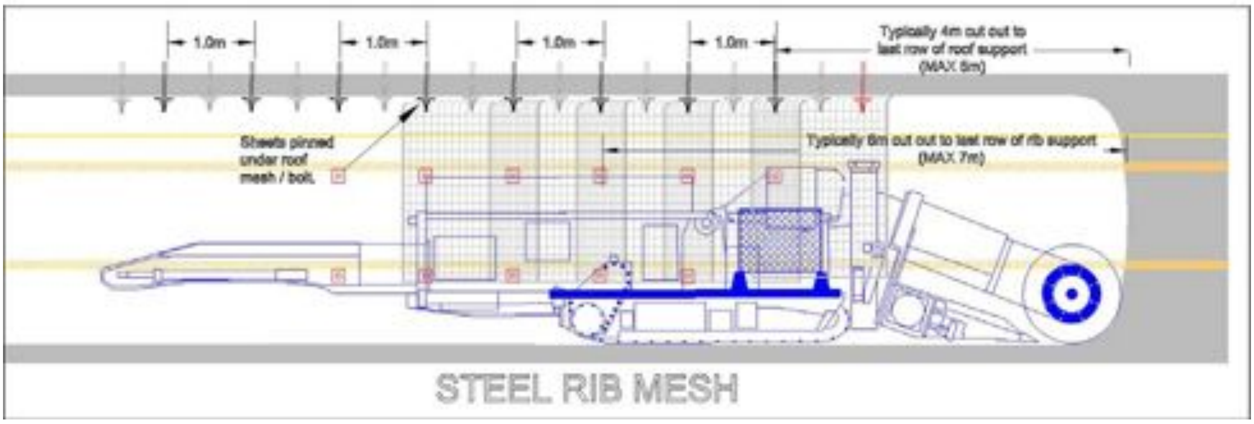
As a priority control measures should focus on:

- Reducing the need for overhead shoulder work.
- Reducing the muscular force required by the shoulders, wrist and back.
- Minimising the vibration forces experienced by the hands.

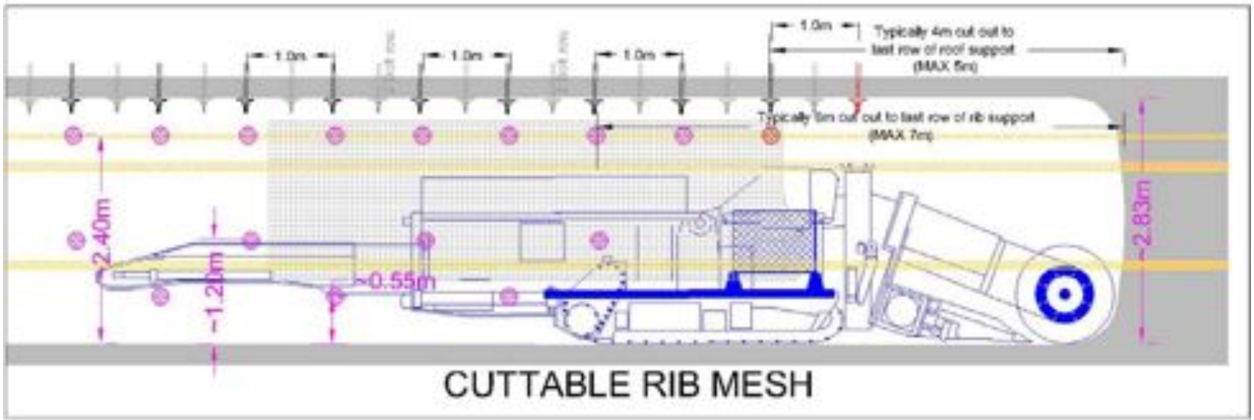
ADDITIONAL INFORMATION



<u>Figure 1:</u> WASP Borer



<u>Figure 2</u>: Bolting pattern on the CM when using steel rib mesh.



<u>Figure 3</u>: Bolting pattern on the CM when using cuttable rib mesh.

RISK CONTROLS

DESIGN CONTROL OPTIONS:

- The long term solution to WASP bolting is to install appropriate drill rigs on the miner, that enable rib bolting. These rigs have been ordered and are currently scheduled to be installed in November 2005.
- The WASP or an appropriate new portable bolter (Windy Borer) should have handles that are vertical. Vertical handles will reduce the strain on the forearm muscles, which currently need to provide extensive griping force to prevent the rotation of the bolter.
- Often the most appropriate equipment is not available and so the nearby gear is used to 'make do'. A purpose built pod containing; appropriate aggressive drill bits, a variety (i.e. 2, 2.5 and 4-foot) of drill steels and the chucks should be located permanently on the miner.
- The platforms on the side of the miner should by extended toward the ribs (up to the width of the platform near the CM mounted drill rig). A platform should also be provided near the CM mounted drill rig to provide an adequate position for the miner to place their feet when drilling the top bolt. These changes to the platforms would allow the miner to gain better foot position when drilling and thus transmit more force to the WASP during drilling without requiring more muscular force.
- Increase the flexibility of the hose to reduce the effort required when manoeuvring the WASP. This should reduce the strain on the shoulders, arms and wrists in particular and may also reduce the need for awkward positions.
- Look into the purchase of cuttable mesh with 'memory'. I.e. mesh that can be unrolled and stays in place rather than having a tendency to curl up again like the current cuttable mesh. Furthermore, this mesh could me mounted on a roll at the front of the miner, which would then unravel as the miner travels forward. The use of such a mesh on a roll would reduce the need to retrieve mesh sheets outbye and would decrease the awkward postures and forces required to hold the mesh in place while putting the initial bolt in to hold it.
- As well as investigating the purchase of 'mesh with memory' the investigation of different drill tips and types of drill steels (designed to 'pull' into the ribs and reduce the required pushing force), was also raised and should be investigated. This has the opportunity to drastically reduce the required pushing force required during drilling, reducing the strain on the upper body muscular structures. Any new risks (e.g. possible increases in drill weight) would also need to be considered.
- Localised hand vibration could be reduced by placing vibration dampening (e.g. rubber) on the WASP handles. However, as the handles already have a large diameter, risks associated with an increased grip size (and the corresponding increase in required muscular wrist force) would also have to be considered.
- Moving the CoG of the WASP (with steel) back towards the miner would decrease the muscular force required by the wrist, shoulders and back, and should be considered.
- The idea of a sliding rig to which the WASP can be attached was raised. Though this idea was dismissed due to its complexity and the fact that it would be made redundant once the permanently mounted rib drill rig is installed in November 2005.

ADMINISTRATIVE CONTROL OPTIONS:

- The WASP should be considered a 2-man task. The practicalities around the development panel should be investigated whilst making this happen.
- Time should be spent on investigating ways to rotate miners who are often performing the WASP rib bolting task.
- Training should be provided to miners on; actual bolting pattern required (including the position of the top bolt relative to the drill rig), the use of aggressive drill tips to reduce the force required during bolting and the housekeeping to maintaining all appropriate gear near the WASP.

ACTION PLANS (raised in meeting)

All control options raised at the safety meeting need to be workshopped further (many on site) to evaluate their effectiveness at reducing the MSD risks, whilst ensuring they maintain (hopefully increase) productivity and do not introduce any new and greater risks.

Summary of the action strategy from here:

- Jerry Wallace to investigate the replacement of the WASP with Windy Borers.
- Jerry Wallace to investigate the 'mesh with memory'.
- Jerry Wallace to investigate new drill bits.
- Further investigation of drill lengths and types to improve drilling.
- Development of drill pod and investigation on its possible location on the CM.
- Extend the major platform and investigate the possibility of building a small platform for the feet during the top bolt drilling.
- Investigate the possibility of increasing the flexibility of the hose.
- Investigate the use of hand vibration dampening on the WASP handles.
- Investigate manning issues around the CM during rib bolting.

PROGRESS STATUS (as of 24TH August 2005)

On Friday the 19th of August an analysis of proposed controls was performed from the analysis the following outcomes were developed:

- Wasp Use - Jerry Wallace organising lease/rent of Windy Borers until CM drill refit. (Handles are vertical and vibration dampening is possible with further investigation).
- The new portable bolter will have more flexible hoses. Set up air and water on sides of CM as per WASP hoses. i.e. ½" water hose, ¾" air hose (black rubber possible not nylex) in sheathing.
- Drill bits - Jim Richardson sourcing 2 Rambor Rib Drills suitable for square drive drills and set up as per above.
- Drill Steels - 40 off 19.5mm diameter fibreglass dowels and plates for trial purpose – 550mm 24mm diameter med resins to suit. To accompany the 2ft and 4ft drill steels, a 2.5ft steel is being sourced and will be trialled.

- Storage Facility - Set up a suitable stock of the correct steels, bits etc in the panel. When all is available we will keep an air supply from end of range to the miner (can be supported off hand straps on VT's). This must be advanced as we advance the water hose so that it is ready to go at all times. Only hook up to back of CM when required. Individual module's for drill steel storage
- Mesh – further investigation to be undertaken in relation to the use of roller guided mesh
- Two person task – two persons maybe permitted to perform the task as required. Individual's should ask for help where required.

PROGRESS STATUS (as of 9th November 2005)

- One miner has been sent away to be refitted with drill rigs for the ribs. The other miner is likely to be refitted early in 2006.
- The windy borer has been purchased and is currently being used at United as a short term measure until the refitted CMs arrive. All indications are that the miners much prefer the Windy to the WASP bolter.
- More aggressive drill bits have been provided to the miners and new steel lengths and types are being investigated, with appropriate storage facilities.
- No 'mesh with memory' has yet been located.
- The task has been mandated as a two-person task ain the SOPs.

PErforM

Participative Ergonomics for Manual Tasks

MANUAL TASKS RISK ASSISSMENT FORM

DATE & WORKPLACE

Date: 2/12/04	**Workplace:** United Colliery

RISK ASSESSORS

Work Unit / Team: Out Bye Crew

Positions: Out Bye miners and tradesmen.

Names: Out Bye Crews, Steve Nash and Gary Dennis

TASK DESCRIPTION

Name of Task: Belt roller change out.

Why was this task selected: This task was selected because the restricted access inside the belt structure combined with the heavy nature of the load required this manual task to be performed using particularly awkward postures.

Location where task occurs: Drift belt.

Who performs the task: Out bye crew, usually 2-man job.

General description: The LHD is loaded with a basket containing the new rollers and driven to the site of the damaged roller. The belt is then isolated and the basket with the rollers is positioned and the pull lifts installed. The person performing the roller change then crawls inside the belt structure and lies down on the lower belt. The pull lifts are used to raise the top belt and pinch bars are used to remove the damaged roller. The new roller is moved into place and replaced (with some difficulty, and using an overhead arm position). The pull lifts are removed and the belt is re-engaged after the miner has climbed out of the belt structure.

Postures: Due to the cramped nature of the task (i.e. between the belt structure) an over head arm position is used to move and align the rollers and the lower back is often hyper-extended.

Forceful / muscular exertions: Forceful exertions of the wrist, forearm and shoulder are required to lift and position the 10 kg roller into place.

Repetition and duration: This discrete task is only performed when a roller needs replacing and the manual handling component of the roller change takes about 10 mins.

Tools or equipment used: Two pull lifts, two 1 m long pinch bars, 7 lb hammer and the roller.

Work / task organisation and environment: The restricted access inside the belt structure is the environmental condition that makes this task awkward.

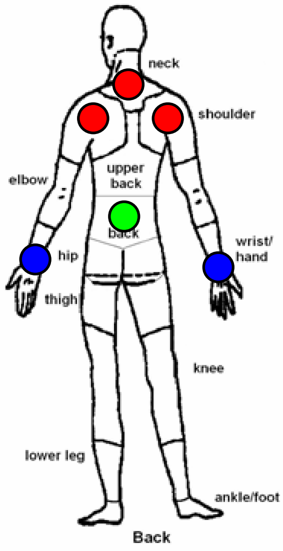
Date: 2/12/04	**Workplace:** United Colliery

Name of task : Roller change out.

RISK ASSESSMENT

Exertion				
1 No effort	2	3 Moderate force & speed	4	5 Maximum force or speed
Awkward posture				
1 All postures neutral	2	3 Moderately uncomfortable	4	5 Very uncomfortable
Vibration				
1 None	2	3 Moderate	4	5 Extreme
Duration				
1 < 10 minutes	2 10 – 30 min	3 30 min – 1 hr	4 1 – 2 hrs	5 > 2 hrs
Repetition				
1 No repetition	2	3 cycle time < 30 s	4	5 cycle time < 10 s

Body part



COMMENTS

As this task is particularly difficult due to the restricted space within the belt structure the miners performing this task have developed methods which have reduced the effort required to perform the task (e.g. lift pulleys). However, even with considerable pre-thought this task still poses a significant risk of injury.

RISK CONTROLS

DESIGN CONTROL OPTIONS:

- Investigate the purchase of rollers that are more reliable and therefore need to be changed less often.
- Investigate the purchase of light weight plastic rollers. However, the durability of these rollers also needs to be considered as well as their weight.
- Investigate the ability of an air bag (rather than the lift pulleys) to lift up the belt and provide access to the belt structure.
- Build a jig design that would enable the rollers to be held and more easily slid into place.

ADMINISTRATIVE CONTROL OPTIONS:

- Ensure that all the gear is stored in one place and is readily available.
- Develop a SOP that is based upon the techniques used by those employees who perform the task most often and as such have developed a method which minimises the stress placed upon the body.

PErforM

Participative Ergonomics for Manual Tasks

MANUAL TASKS RISK ASSISSMENT FORM

DATE & WORKPLACE

Date: 2/12/04	**Workplace:** United Colliery

RISK ASSESSORS

Work Unit / Team: Out Bye Crew

Positions: Out Bye miners and tradesmen.

Names: Out Bye Crews, Steve Nash and Gary Dennis

TASK DESCRIPTION

Name of Task: Pump change out

Why was this task selected: This task was selected because the design and location of the pump (Figure 1) requires particularly heavy and awkward lifting. In addition, this task is often performed by one person and in muddy conditions.

Location where task occurs: In underground muddy areas that require the removal of excessive water.

Who performs the task: Generally the out bye deputy performs this task on their own.

General description: Whenever a pump is no longer functioning properly it is changed. First a new pump (often 50 kg) is loaded into the SMV on the surface. It is then driven to the site of the old pump and unloaded from the back of the SMV. The old pump is disconnected and the new one fitted. The old pump is then loaded onto the SMV and transported to and unloaded on the surface.

Postures: In order to lift the pump in and out of the back of the SMV bending and twisting of the truck is required and the arms in particular are fully extended due to the large size of the pump.

Forceful / muscular exertions: Maximal muscular exertions are required by the muscles of the back, shoulder and forearm when lifting and carrying the pump (50 kg).

Repetition and duration: This task is performed on average once per week and the manual handling component of the pump change out lasts about 20 mins.

Tools or equipment used: Various pumps depending on the volume of water that needs to be moved (up to 50 kg) and the SMV.

Work / task organisation and environment: Conditions that make this task awkward are the uneven and muddy floor conditions in the wet areas of the mine.

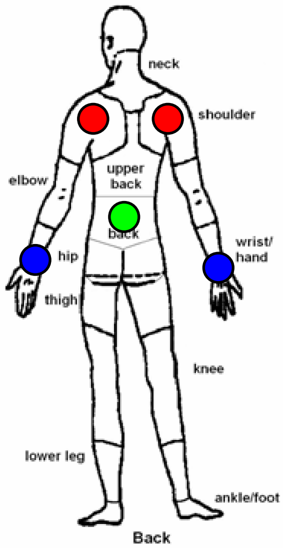
Date: 2/12/04	**Workplace:** United Colliery

Name of task : Pump change out.

RISK ASSESSMENT

Exertion				
1 No effort	2	3 Moderate force & speed	4	5 🟢🔴🔵 Maximum force or speed
Awkward posture				
1 All postures neutral	2	3 🔴 Moderately uncomfortable	4	5 🟢🔵 Very uncomfortable
Vibration				
1 🟢🔴🔵 None	2	3 Moderate	4	5 Extreme
Duration				
1 < 10 minutes	2 🟢🔴🔵 10 – 30 min	3 30 min – 1 hr	4 1 – 2 hrs	5 > 2 hrs
Repetition				
1 🟢🔴🔵 No repetition	2	3 cycle time < 30 s	4	5 cycle time < 10 s

Body part



COMMENTS

This task is particularly strenuous as the pump is particularly heavy and is difficult to move through often muddy conditions. A circular frame has been fitted to the outside of the pump (Figure 1) so that it can be move easily rolled to and from the SMV (though this can be achieved in muddy conditions). However, the circular nature of this frame also causes it to slip / rotate on the SMV step which makes it more difficult to lift into the vehicle. If the pumps were lighter the risks associated with this task would be significantly reduced. Alternatively, if the pumps were more durable or if they could be serviced at their underground location the risks maybe almost eliminated as the task would be rarely performed.

RISK CONTROLS

DESIGN CONTROL OPTIONS:

- Install an in-line air filter and in-line oil lubricator so that the pump breaks down less often and thus the task rarely needs to be performed.
- Train certain miners in the maintenance of the pumps (which maybe quite simple) so that they can be serviced on site rather that transporting them to an outside service department. This not only would reduce risk it may very well save time and money.
- Use lighter weight pumps, either two lighter pumps (Figure 2) in parallel or purchase newer pumps which although lighter still can move the same volume of water.
- Install a small Hiab crane on the back of the SMV to aid in lifting it into the SMV.
- Install a boat winch on the back of the SMV to aid in lifting it into the SMV.
- Use a rope on the frame of the pump to stop it slipping when manually lifting it into the back of the SMV.
- Store pumps on the surface at waist height rather than in a container at floor level (Figure 3).

ADMINISTRATIVE CONTROL OPTIONS:

- Mandate the task as a two man job.
- Use a LHD rather than a SMV to move the pump.
- Only move the old pump out when there are two men available to perform the task.

<u>Figure 1</u>: High volume pump with a circular frame.

<u>Figure 2</u>: Lightweight pump.

<u>Figure 3</u>: Lifting a 'screamer' pump out of a 'low' storage bin.

PErforM

Participative Ergonomics for Manual Tasks

MANUAL TASKS RISK ASSISSMENT FORM

DATE & WORKPLACE

Date: 3/2/05	**Workplace:** Metropolitan Colliery

RISK ASSESSORS

Work Unit / Team: Miners from the development and long wall crews.

Positions: Miners and tradesmen.

Names: Miners from the development and long wall crews, Bob Myatt and Gary Dennis.

TASK DESCRIPTION

Name of Task: Handling and loading the PA Cable

Why was this task selected: This task was selected because it involves moving the PA Cable, which is particularly heavy (especially the plug) and it involves awkward bent over, twisting and reaching postures. In addition, it is a task that is routinely performed as the long wall advances. Of note several miners believed that handling the PA Cable contributed significantly to back pain they experienced at some point in the mining industry.

Location where task occurs: Development panel.

Who performs the task: 1 – 3 men (electrician and miners).

General description: As the long-wall advances the PA Cable is coiled in a figure-8 fashion into a 3 meter long cassette for storage. The cable is 4 inches in diameter and the plug weighs approximately 50 kg. The cassette is at floor level which requires the miner to bend, twist and reach when lowering the cable into it. However, some miners use the gear on the advancing wall to help load the cassette and guide the cable rather than manual handle the cable into the cassette.

Postures: Awkward postures of the back, shoulders, neck and forearms occur; when bent over loading the cable into the cassette. Stooped postures of the spine also occur when lifting the PA Cable plug.

Forceful / muscular exertions: Large muscular exertions are required by the muscles of the back, shoulder and forearm when lifting and positioning the cable in the cassette due to the weight of the cable and the diameter of the cable. The 4 inch diameter of the cable requires large muscular exertions of the forearm to hold the cable. In addition very large muscular exertions are required when lifting and carrying the heavy PA Cable plug.

Repetition and duration: On average the cable needs to be loaded into the cassette two times per 9.5 hour shift, which takes between 10 to 15 minutes.

Tools or equipment used: PA cable and plug, knife to cut away straps and cassette.

Work / task organisation and environment: Conditions that make this task awkward are the uneven and muddy floor conditions, the minimal space in which the tasks must be performed and the stiffness of the cable.

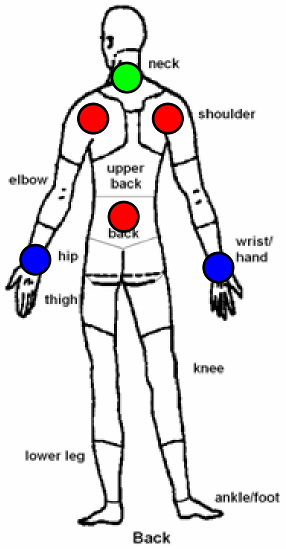
Date: 3/2/05	**Workplace:** Metropolitan Colliery

Name of task: Handling and loading PA Cable.

RISK ASSESSMENT

Exertion				
1 No effort	2	3 Moderate force & speed	4	5 Maximum force or speed
Awkward posture				
1 All postures neutral	2	3 Moderately uncomfortable	4	5 Very uncomfortable
Vibration				
1 None	2	3 Moderate	4	5 Extreme
Duration				
1 < 10 minutes	2 10 – 30 min	3 30 min – 1 hr	4 1 – 2 hrs	5 > 2 hrs
Repetition				
1 No repetition	2	3 cycle time < 30 s	4	5 cycle time < 10 s

Body part



COMMENTS

The PA Cable (power cable for the long wall) is particularly long heavy and with a large diameter. The most common reason for handling the PA Cable is to coil it (into 3m long pods) as the long wall progresses. Occasionally, the cable needs to be disconnected and reconnected, which requires a lot of force to drag it along the floor in the panel section. Also of note is the plug which is particularly heavy.

RISK CONTROLS

DESIGN CONTROL OPTIONS:

- Decrease the diameter of the cable from 4 inches. This will better enable miners to hold the cable without an overextended grip, which will inturn reduce the force required by the muscles of the forearm.
- Reduce the weight of the cable per meter and reduce the weight of the plug, so that less stress is placed upon the back shoulders and forearms.
- Install feeder rollers on the cassette to enable the cable to be coiled more easily, reducing the time involved and the load on the musculoskeletal structures.
- Increase the flexibility of the cable so that the cable can be coiled more easily, reducing the load on the musculoskeletal structures, particularly the forearm.
- Install cable reals at each cut through, which are designed to roll up enough cable from the previous cut through. This real can subtract the cable as the long-wall advances and then rolled away as the long-wall starts on the next panel. This would take out almost all manual handling risks associated with manual PA cable handling.

ADMINISTRATIVE CONTROL OPTIONS:

- Use the PANTEC to load the cable.
- Develop SOPs based on the miners that feed the cable from the top of the reel rather that handling the cable from the bottom of the reel into the cassette.

PErforM

Participative Ergonomics for Manual Tasks

MANUAL TASKS RISK ASSISSMENT FORM

DATE & WORKPLACE

Date: Dec 03	**Workplace:** Metropolitan Colliery

RISK ASSESSORS

Work Unit / Team: Gas Drainage Crew.

Positions: Gas Drainage Miners tradesmen.

Names: Gas Drainage Crew, Wayne Green and Gary Dennis

TASK DESCRIPTION

Name of Task: Gas drainage.

Why was this task selected: The sole task of the gas drainage crew is to extract dangerous gases (CH_4 and CO_2) from the development panel in preparation for coal extraction. As a result, miners in this crew perform a single task for the duration of every shift. The repetitive and continuous nature of this task has led to a number of repetitive strain type injuries, particularly to the shoulders and wrist.

Location where task occurs: Development panel

Who performs the task: A two-man team work together each shift performing the gas drainage task using a purpose build gas drainage drill rig. One member of the team generally operates the rig whilst the other team member performs all manual tasks for the duration of a shift, and then they rotate jobs for the next shift.

General description: A 2.4 m long rod (12 kg) is lifted from a near bye storage pod and placed onto the feed bed of the drill rig (Figure 1). Once the previous rod length has been drilled the water swivel at the end of the rod is unscrewed and the next rod is lifted and screwed into the previous rod. The water swivel is then carried to the end of the new rod and screwed into the back of that section. Often a shifter is needed to tighten or loosen the threads (Figure 2). The rest time between each rod (whilst drilling takes place) is typically 2 – 3 mins, and anywhere from 200 – 600 rods maybe installed or removed in a shift.

Postures: Awkward postures of the back, shoulders and forearms occur; when bent over the feed bed, lifting the rod from a high position of the storage pod and during the screwing task.

Forceful / muscular exertions: Large muscular exertions are required by the muscles of the back, shoulder and forearm when lifting and positioning the rods, and in the wrist extensors and flexors when screwing each new section to the previous rod.

Repetition and duration: The team member performing the manual task during the shift handles and screws anywhere from 200 - 600 tubes in a shift (3600 wrist rotations repetitions), and does this task for the duration of the 8 hour shift.

Tools or equipment used: Drill rig, 2 m tubes (12 kg), water swivel (4 kg) and shifting spanner.

Work / task organisation and environment: Conditions that make this task awkward are the uneven and muddy floor conditions and the repetitive nature of the task with no job rotation.

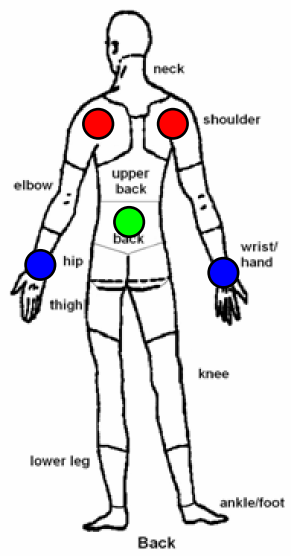
Date: Dec/03	**Workplace:** Metropolitan Colliery

Name of task: Gain drainage.

RISK ASSESSMENT

Exertion				
1 No effort	2	3 ● (green) Moderate force & speed	4 ● (red)	5 ● (blue) Maximum force or speed
Awkward posture				
1 All postures neutral	2 ● (green)	3 ● (red) ● (blue) Moderately uncomfortable	4	5 ● (green) Very uncomfortable
Vibration				
1 ● (green) ● (red) ● (blue) None	2	3 Moderate	4	5 Extreme
Duration				
1 < 10 minutes	2 10 – 30 min	3 30 min – 1 hr	4 1 – 2 hrs	5 ● (green) ● (red) ● (blue) > 2 hrs
Repetition				
1 ● (green) No repetition	2 ● (red)	3 cycle time < 30 s	4	5 ● (blue) cycle time < 10 s

Body part



COMMENTS

This is the only task performed by the gas drainage crews, and if no job rotation occurs during the shift then the team member performing the manual tasks associated with this task will do so for the duration of the shift. In particular the shoulders and the wrists have been identified as the areas of greatest risk of musculoskeletal injury. Based upon an average of 200 tubes being installed or removed each shift and if 6 rapid wrist extensions and/or contracts are required for each thread then the miner will perform 3600 wrist rotations per shift.

RISK CONTROLS

DESIGN CONTROL OPTIONS:

- Move the feed bed on the older drill rig to edge of the rig so that it is closer to the miner and reduces the moment arm relative to the lumbar spine and shoulders when handling the tubes.
- Look into a new clipping mechanism between the tubes so that don't have to be screwed into one another.
- Knurl the water swivel so that it is easier to grip and thus reduces the grip pressure required by the miners (Figure 3). Additionally, change the flat section at the rear of the water swivel so that it is a hexagonal rather than 2 flat sections and provide a fixed spanner rather a shifter to fit the hexagonal nut precisely.
- Affix a rotational lever system on the water swivel to increase the moment arm while tightening or loosening the water swivel.
- Move or remove the cable reel from the older drill rig to improve the access to the back of the miner.
- Examine if the pivot point on the back of the miner can be moved closer to the front of the drill rig to reduce the torque required to align it with the previous tube.
- Ensure that there is a regular maintenance or replacement of the tubes so that the threads are easy to screw whilst still remaining water tight. Leaking tubes resulted in muddy conditions around the rig, which increased the slip and trip hazard.

ADMINISTRATIVE CONTROL OPTIONS:

- Rotate the two man crew within the shift not just between shifts.
- Instruct the miners to share the load between the flexors and extensors of the wrist during screwing tasks by alternating between and overhand and an underhand position on the tubes.
- Develop a SOP that involves fitting the next tube whilst standing alongside the joint rather than at the far end of the tube and pushing against the pivot point to align it.

Figure 1: Removing water swivel on gas drainage tube

Figure 2: Tightening tubes with the shifter

Figure 3: Old (left) and new (right) water swivels

PErforM

Participative Ergonomics for Manual Tasks

MANUAL TASKS RISK ASSISSMENT FORM

DATE & WORKPLACE

Date: 10/2/05	**Workplace:** Metropolitan Colliery

RISK ASSESSORS

Work Unit / Team: Miners from the development and long wall crews and "weekend warriors".

Positions: Miners and tradesmen.

Names:

TASK DESCRIPTION

Name of Task: Installing and removing 4 inch overhead pipes.

Why was this task selected: The installation and removal of overhead pipes is a task that is routinely performed for the duration of the 9.5 hour work shift. It involves heavy lifting often with awkward postures and over long durations.

Location where task occurs: Anywhere underground.

Who performs the task: 3 men.

General description: Load 7 pipes into the racks on the back of the EIMCO and travel to the installation site. Install the hanging chain to the roof. Slide pipe out and 2 men lift overhead and into place. Pull the changing chain around the pipe and screw the coupling onto the pipe once it is aligned with the previously installed pipe

Postures: Awkward bent over and reaching postures are involved in lifting, passing and sliding the pipe out of the racks. Awkward postures of the shoulder in particular are involved in the overhead positions when coupling the pipe sections together.

Forceful / muscular exertions: Each 4 inch pipe section is 6 meters long and weighs approximately 30 kg. The heavy nature of the pipe combined with its long length makes the pipe difficult to handle and thus involves large muscular forces with the ensuing stress on the relevant musculoskeletal structures. The large diameter of the pipe can also place stress on the muscles of the forearm when picking up and handling the pipe sections.

Repetition and duration: On average 20 – 60 pipes are installed in a 9.5 hour shift. The installation of overhead pipes is typically performed by the same miners for the duration of the shift.

Tools or equipment used: 6 meter long 4 inch pipes (30 kg), hanging chains, shifting spanner, paddle pops, rack, EMICO and PET.

Work / task organisation and environment: Conditions that make this task awkward are the height of the installation (I.e. overhead and standing upon equipment to get to the required height). Also the environmental conditions are often hot due to the heat produced by the EMICO when running.

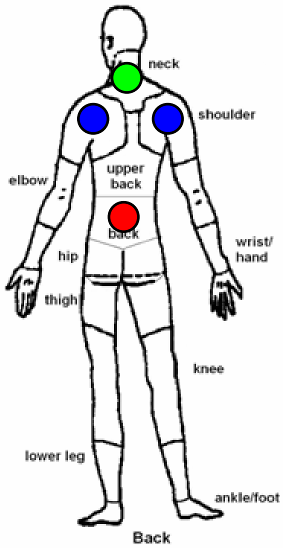
Date: 10/2/05	**Workplace:** Metropolitan Colliery

Name of task : Installing and removing 4 inch overhead pipes.

RISK ASSESSMENT

Exertion				
1 🟢 No effort	2	3 🔴 Moderate force & speed	4 🔵	5 Maximum force or speed
Awkward posture				
1 All postures neutral	2	3 Moderately uncomfortable	4 🟢 🔴	5 🔵 Very uncomfortable
Vibration				
1 🟢 🔴 🔵 None	2	3 Moderate	4	5 Extreme
Duration				
1 < 10 minutes	2 10 – 30 min	3 30 min – 1 hr	4 1 – 2 hrs	5 🟢 🔴 🔵 > 2 hrs
Repetition				
1 🟢 🔴 🔵 No repetition	2	3 cycle time < 30 s	4	5 cycle time < 10 s

Body part



COMMENTS

Overhead pipes are required to be installed throughout all areas of the underground section of the mine. As a result they are routinely and commonly installed throughout the mine where they are suspended from the roof. The primary problems associated with this installation and removal tasks is that the pipes are long and heavy and are required to be handled overhead which increases the risk of shoulder injury.

RISK CONTROLS

DESIGN CONTROL OPTIONS:
• A purpose built pipe installer would be the best way to reduce the risk of shoulder and back injury. Currently, Tarhore and West Cliff mines have developed and are using purpose built pipe installers, which may be able to be modified to suit Metropolitian Colliery. This machine is attached to the side of mobile plant equipment (typically a MPU). In essence it has two U-shaped seats in which each end of the pipe rests. Each end is then individually hydraulically controlled to extend out and up from the vehicle to position the pipe into place. As this point the coupling device connecting the two pipes and the hanging chain are installed as per normal. • Overhead tube assistance stcuture that the tubes roll up (Figure 1).
ADMINISTRATIVE CONTROL OPTIONS:
• Use both the PET and the EMICO to install pipes. This enables the pipes to be slid from one to the other and reduces the manual lifting required. • SOPs to standardise the operation so that miners are aware of lifting and sliding the pipes from their ends rather than from the middle of the pipe sections, etc.

Figure 1: Assisted tube lifting structure.

Appendix C

Site Standard incorporating PErforM

HSEC STD 4.06.201 Manaul Tasks

Purpose

To reduce the risk of musculoskeletal injury to persons involved in performing manual handling tasks, promote safe manual handling practices and provide tools to aid the assessment and control of manual handling risks.

Scope

This standard applies to all persons employed by or working at United Collieries. The principles outlined in this standard should be considered when Performing manual tasks.

The objective of this standard is to protect personnel from manual handling hazards arising from working at United. This includes establishing requirements for designers, manufacturers, suppliers, persons with control of a workplace, and persons with control of work to prevent injury to workers and reduce the severity of any injury that may arise by:

- eliminating manual handling hazards, or
- where elimination is not practicable, control the risks posed by these hazards to the lowest practicable levels

Standard

The requirements of the Occupational Health and Safety Regulations 2001 Cl 80(1) states an employer must ensure that:

- all objects, where appropriate and as far as reasonably practicable, must be designed, constructed and maintained so as to eliminate risks arising from manual handling of objects.
- work practices used in a workplace are to be designed so as to eliminate risks arising from manual handling.
- the working environment is to be designed as far as reasonably practicable within the extent of the employer's control, consistent with the safe handling of objects.

Risk Identification

All persons at United PErforM manual handling tasks and therefore should be involved in the risk identification process of manual handling hazards that might arise from the use of equipment or systems of work. The risks associated with Manual Handling tasks may be identified via a number of process at United including;

- analysis of work place injury records;
- consultation with employees;
- direct observation; and
- use of the United PErforM Manual Handling Risk Assessment tool. (**Appendix 1**)

Risk Assessment

The assessment of risks that arises or may arise from manual handling hazards shall be undertaken at United as required utilizing the methods listed in the risk identification section of this standard and in conformance with United's HSEC Risk Management Standard.

Risk Control

Risk assessment and controls will first attempt to eliminate manual handling hazards arising, or have the potential to arise as a result of operation at United Collieries. If the elimination of manual handling risks is not possible then mitigation of the risk should be undertaken and as a minimum this should consider:

- workers' postures;
- the forces exerted by worker(s);
- repetition and speed of movements by worker(s);
- workers' exposure to vibration;
- the duration of tasks;
- workplace/workstation layouts;
- work environments;
- the characteristics and locations of items; and
- work organisation and systems of work.

Design & Designers

When items and systems of work are designed, re-designed or altered consideration will be given to manual tasks so that the risk of musculoskeletal injury to workers is minimized.

Manufacturers and Suppliers

When entering into a contract for service, United as a minimum, requires manufacturers and suppliers consider;

- Consultation with other duty holders, and affected workers and/or their representatives, on the intended uses of items and systems of work is undertaken.
- That items and systems of work are designed, manufactured and supplied so that workers are not exposed to manual handling hazards as a result of the use of the items or systems of work.

Training & Competency

All members of the workforce at United Collieries will be trained in the basics of this Standard. The training will include an overview of the Standard itself and the various manual handling risk assessment processes. Practical manual handling training will be undertaken as required. Everyone must clearly understand their obligations with regard to the management of manual handling risks and what they need to do to manage risks and prevent musculoskeletal disorders.

Communication Consultation

Communication will involve the provision of information on the intended and safe use of the items or systems of work to all persons to whom the items or systems of work is supplied, furthermore the updating of this information will occur whenever new information on manual handling aspects of the items or systems of work becomes available to them is undertaken; and the provision of this updated information with all subsequent supplies of the items or systems of work is to be communicated/provided.

Consultation on Manual Handling Hazards will take place at several stages throughout the United work process, including;

- the design, re-design or alteration of the workplace;
- the introduction of new items or systems of work;
- during hazard identification;

- during risk assessment;
- during hazard elimination and risk control; and
- during monitoring and reviews of risk control measures.
- When individuals are involved in a process/task which they have not previously undertaken.

Consultation may involve:

- safety committee meetings;
- staff meetings;
- trials of equipment;
- system pilots;
- the use of specialized ergonomists or other suitably qualified professionals
- the distribution of draft floor plans;
- visits to other workplaces to view systems and equipment and talk to users;
- discussions with other users who may be affected by a change;
- discussions with insurers, employer associations, professional people, workers and consultants;
- trial work areas (mapped out with tape etc); and
- the development of hazard identification checklists for the workplace.

Document Control

The retention of records of any such risk assessments and risk control measures will be maintained for as long as the items or systems of work are reasonably expected to remain in use. All Manual Handling risk assessment documentation must be archived and filed electronically.

Definitions

Term	Definition
Manual Tasks (Task Based)	Manual handling means any activity requiring a person to use any part of their muscular or skeletal system in their interactions with their workplace, and includes: ■ lifting, lowering, pushing, pulling, carrying or otherwise moving, holding or restraining any animate or inanimate object; ■ repetitive actions; and ■ sustained postures. Manual handling also describes tasks involving: ■ repetitive actions, with or without force; ■ sustained work postures; and ■ exposure to whole body or hand-arm vibration.
Manual Handling (Movement /Posture Based)	Every task involving manual handling. Manual tasks include, but are not restricted to any tasks that involves, ■ lifting or lowering; ■ pushing or pulling; ■ holding or restraining;

	■ carrying or otherwise handling; ■ throwing or rolling; ■ grasping or manipulating; and ■ striking an object, with or without a tool. ■ vibration
Occupational Overuse Syndrome (OOS)	Also known as repetitive strain injury, is a collective term for a range of conditions characterised by discomfort or persistent pain in muscles, tendons and other soft tissues, with or without physical manifestations. OOS is usually associated with manual handling tasks that involve repetitive or forceful exertions or both, and/or maintenance of constrained or awkward postures. A one-off event or accident does not cause most OOS injuries, they usually occur as a result of repeated exposure to smaller, sometimes unnoticed injuries. Frequent exposure to "microtrauma" has an additive effect, which means that injury may, develop gradually over weeks, months or even years.
Repetitive movements	Repetitive tasks require frequent and rapid muscle contractions. More cumulative muscle effort is required for these tasks than for non-repetitive tasks and therefore more time is needed for muscle recovery. If recovery time is insufficient, the risk of developing OOS is increased. In effect, tasks that are relatively harmless when Performed in isolation, can produce significant and long-term disability if repetitive in nature.
Maintaining fixed and constrained postures	Poor posture is a significant contributor to the onset of OOS, especially: – static postures (where muscles hold the body in positions for long periods); – awkward or uneven posture(e.g. those that involve twisting or are symmetrical); and – postures that continuously place large loads on muscles, ligaments and tendons. These fixed postures increase the risk of injury by reducing blood flow which can lead to muscle fatigue as well as tissue damage due to the build up of waste products.
Forceful movements	The forces required by a task can result in small tears to the muscles. If such microtrauma occurs in the same area over and over again, it can lead to long term injury.
Vibration **(Whole Body)**	Tasks that involve high levels of vibration can also represent a significant OOS risk. Long term exposure to vibration can cause closure of small veins and arteries. Common symptoms experienced when exposed to vibration include numbness; tingling and coldness in fingers; pale, ashen skin; and eventual loss of feeling and control in hands.
Extremes of joint range	Muscle capacity decreases when joints are not in their most efficient, neutral postures, (i.e. when muscles are at their maximum length, or substantially shortened, they are not as strong and can strain or tear more easily).
Muscle Fatigue	Fatigue occurs when blood cannot reach the muscle effectively resulting in a build up of waste products and a lack of oxygen and nutrients that the muscles need to carry out work. Insufficient rest for muscle recovery contributes to fatigue and hence the onset of OOS. Resting muscles does not necessarily mean stopping work altogether. It can involve ensuring task variety that allows rest and recovery of specific muscle groups, (e.g. rotating from a whole body task, to a hand task, or to a mental task).

Accountabilities

Role	Function for this document
Operations Manager / Mine Manager	Oversee that manual handling systems and processes are in place in accordance with legislative and Xstrata requirements.
Department Managers / Coordinators	Check that the manual handling process and objectives are understood and implemented by all subordinates and contractors.
Supervising Mine Worker	Conduct and review risk assessments in your area to identify potential manual handling risks.
Safety Systems Co-ordinator	Advise, educate and coach Managers and Superintendents Oversee the education of employees and contractors in risk management systems and processes to identify assess and control for manual handling risks.
All Persons	Undertake training to understand and identify manual handling risks as required. Where required use the manual tasks risk assessment to identify risk associated with manual tasks Use appropriate manual handling techniques when Performing all manual tasks. Report all manual handling concerns as appropriate according to United Measurement and Reporting Standard. Aid in the control of manual handling risks

References

Legislation & Guidelines

- Occupational Health & Safety Act 2000 & Regulations 2001
- MDG 5003 Guidelines for Contractor OH&S
- National Code of Practice for the Prevention and Management of Occupational Overuse Syndrome 1994

Xstrata Plc Standard

- Standard 9: Health & Hygiene

Xstrata Coal NSW Documents

- HSEC Manual Handling Standard

United Documents

- United PErforM Manual Handling Risk Assessment Tool

External Reference

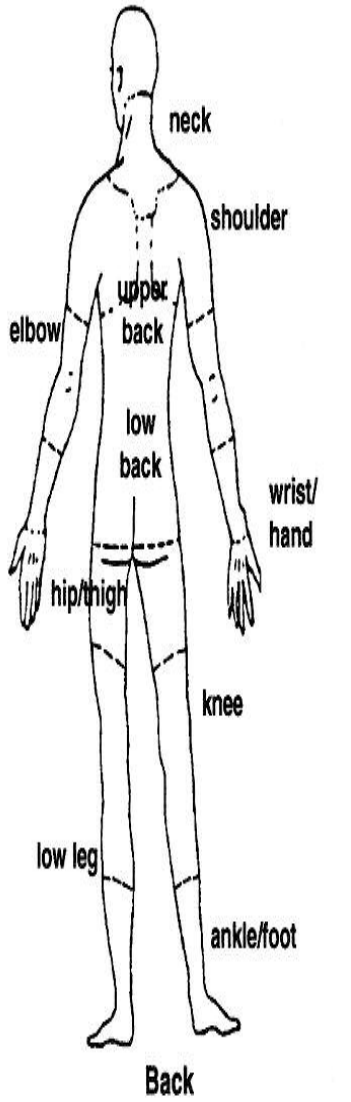
- Burgess-Limerick, R., Joy, J., & Straker, L. (2004). Reducing Musculoskeletal Risk in Open Cut Coal Mining. ACARP Project C11058 Final Report. http://ergonomics.uq.edu.au/download/C11058.pdf

Appendix 1

PErforM	
Participative Ergonomics for Manual Tasks	
MANUAL TASKS RISK ASSESSMENT FORM	
Date:	**Work Location:**
RISK ASSESSORS	
Department / Crew: **Positions:** **Names:**	
TASK DESCRIPTION	
Name of Task: **Why was this task selected:** **Location where task occurs:** **Who PErforMs the task:** **General description:** **Postures:** **Forceful / muscular exertions:** **Repetition and duration:** **Tools or equipment used:** **Work / task organisation and environment:**	

RISK ASSESSMENT

Exertion				
1 No effort	2	3 Moderate force & speed	4	5 Maximum force or speed
Awkward posture				
1 All postures neutral	2	3 Moderately uncomfortable	4	5 Very uncomfortable
Vibration				
1 None	2	3 Moderate	4	5 Extreme
Duration				
1 < 10 minutes	2 10-30 min	3 30 min – 1 hr	4 1 – 2 hrs	5 > 2 hrs
Repetition				
1 No repetition	2	3 cycle time < 30 s	4	5 cycle time < 10 s



Body part

Comments

RISK CONTROLS

DESIGN CONTROL OPTIONS:

ADMINISTRATIVE CONTROL OPTIONS: