An assessment of the repetitive manual tasks of cleaners

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Abstract
WorkCover NSW established a Steering Committee to investigate musculoskeletal disorders (MSDs) in the cleaning industry following advice arising from the Workplace Safety Summit 2002. In September 2004, Health & Safety Matters Pty Ltd was appointed to undertake research into this area, with a focus on conducting an assessment of the upper limbs demands of repetitive cleaning tasks, and to provide advice on reducing the risk of MSDs. The objectives of the project were to: 1. explore the impact of upper limb musculoskeletal disorder injuries amongst cleaners; 2. describe the physical and work organisational demands of the upper limb work in cleaning; 3. develop an evidence-based guide to be used in conjunction with risk assessment checklists; and 4. develop with industry, case study examples of risk assessment to address hazards commonly faced by general cleaning. The literature shows there is strong evidence to support the link between work related upper limb MSDs and physical risk factors such as force, posture, repetition, vibration or a combination of these factors; work organisation factors; and individual factors such as age and gender. Therefore, this study investigated all of these areas using a number of quantitative and qualitative data collection methods. Interviews were conducted with 66 cleaners at 23 worksites, and these explored work organisation and individual factors. Observation of the equipment, work environment and work tasks were conducted to gather information on current practices. Video footage was taken of 47 cleaners performing common cleaning tasks identified by the Steering Committee, and these videos were analysed using the Manual Tasks Risk Assessment Tool (ManTRA) and Rapid Upper Limb Assessment Tool (RULA) to determine the level of risk for upper limb MSD associated with these tasks. Findings from this study are consistent with other research into cleaning work overseas and in Australia that has confirmed that the physical demands, work organisation factors and individual characteristics of workers present a number of risk factors known to contribute to injury and disease, including specific risks for the development of upper limb MSDs. The physical risk analysis identified that each of the most commonly performed cleaning tasks were assessed as “requiring changes”, with wet-mopping requiring the most immediate action. The upper limb was assessed as being at particular injury risk due to the combination of repetition with the other risk factors. The interviews with workers in this study highlighted the risks due to work rates, lack of control over the amount of work, lack of ability to obtain help (if required), as well as the lack of support from supervisors. Also of concern was the reported lack of consultation (eg regarding equipment selection and work rate setting) in many businesses, together with their low levels of responsiveness to problems or maintenance.

Keywords
repetitive, manual, cleaners, assessment, tasks

Disciplines
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ASSESSMENT OF THE REPETITIVE MANUAL TASKS OF CLEANERS

FOREWORD

COMMISSIONED RESEARCH FINAL REPORT: ASSESSMENT OF THE REPETITIVE MANUAL TASKS OF CLEANERS

WorkCover NSW commissioned this research in 2004 in response to recommendations arising from the 2002 NSW Workplace Safety Summit.

The aim of this research was to assess the occupational health and safety risks associated with repetitive manual tasks of cleaners, with a view to providing advice on reducing the risk of musculoskeletal diseases (MSDs). The research focused on assessment of the upper limbs demands of repetitive cleaning tasks. It is anticipated that this research will be relevant for cleaning work performed in a wide range of industries.

The researcher made a number of recommendations for consideration by WorkCover. Published here are the Recommendations to WorkCover. These are based on the original recommendations made by the researcher, and have been reviewed for feasibility by WorkCover. A number will be prioritised and implemented through alignment with WorkCover strategies targeting manual handling. This will include:

- reviewing existing WorkCover NSW guidance materials to determine consistency with findings from this body of research
- providing tailored resources to the WorkCover Inspectorate
- ongoing review of relevant research
- promoting appropriate resources within rehabilitation networks.

Published here are the products from this research project:

- the final report: Assessment of the Repetitive Manual Tasks of Cleaners, with recommendations to WorkCover
- the guidelines: An Evidence Based Guide for Safer Cleaning Work.
Final Report

Assessment of the Repetitive Manual Tasks of Cleaners

prepared for the

Cleaning Industry Steering Committee
WorkCover NSW

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- Australian Liquor Hospitality and Miscellaneous Workers Union (NSW Branch)
- Broadlex Cleaning Australia
- Building Service Contractors Association of Australia
- Medical representative (independent medical practitioner)
- Menzies Group of Companies
- Newcastle University representative (independent academic)
- Swan Services Pty Ltd
- WorkCover NSW

Other organisations:
- Clubs NSW – Registered Clubs Association
- Hotel, Motel and Accommodation Association
- NSW Department of Education and Training
- NSW Department of Commerce – State Procurement
- Tempo Services Limited

The authors also sincerely thank and acknowledge the employers and site owners/managers who generously gave their time and their advice and assisted by completing surveys, allowing the authors to visit their premises, observe the cleaning tasks and interview their cleaning workers. Very special thanks to the cleaning workers who gave their time and advice and participated in the interviews and discussions and particular thanks to those who also participated in the more detailed video analyses.

Disclaimer

This research was commissioned by WorkCover NSW on behalf of the Cleaning Steering Committee. The research conclusions and any views expressed are not necessarily those of WorkCover NSW.
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Executive Summary

WorkCover NSW established a Steering Committee to investigate musculoskeletal disorders (MSDs) in the cleaning industry following advice arising from the Workplace Safety Summit 2002. In September 2004, Health & Safety Matters Pty Ltd was appointed to undertake research into this area, with a focus on conducting an assessment of the upper limbs demands of repetitive cleaning tasks, and to provide advice on reducing the risk of MSDs.

The objectives of the project were to:
1. explore the impact of upper limb musculoskeletal disorder injuries amongst cleaners;
2. describe the physical and work organisational demands of the upper limb work in cleaning;
3. develop an evidence-based guide to be used in conjunction with risk assessment checklists; and
4. develop with industry, case study examples of risk assessment to address hazards commonly faced by general cleaning.

The literature shows there is strong evidence to support the link between work related upper limb MSDs and physical risk factors such as force, posture, repetition, vibration or a combination of these factors; work organisation factors; and individual factors such as age and gender. Therefore, this study investigated all of these areas using a number of quantitative and qualitative data collection methods.

Interviews were conducted with 66 cleaners at 23 worksites, and these explored work organisation and individual factors. Observation of the equipment, work environment and work tasks were conducted to gather information on current practices. Video footage was taken of 47 cleaners performing common cleaning tasks identified by the Steering Committee, and these videos were analysed using the Manual Tasks Risk Assessment Tool (ManTRA) and Rapid Upper Limb Assessment Tool (RULA) to determine the level of risk for upper limb MSD associated with these tasks.

Findings from this study are consistent with other research into cleaning work overseas and in Australia that has confirmed that the physical demands, work organisation factors and individual characteristics of workers present a number of risk factors known to contribute to injury and disease, including specific risks for the development of upper limb MSDs.

The physical risk analysis identified that each of the most commonly performed cleaning tasks were assessed as requiring changes, with wet-mopping requiring the most immediate action. The upper limb was assessed as being at particular injury risk due to the combination of repetition with the other risk factors.

The interviews with workers in this study highlighted the risks due to work rates, lack of control over the amount of work, lack of ability to obtain help (if required), as well as the lack of support from supervisors. Also of concern was the reported lack of consultation (eg regarding equipment selection and work rate setting) in many businesses, together with their low levels of responsiveness to problems or maintenance.

The large proportion of workers that reported pain and discomfort, as well as the average age of the cleaning workforce and large proportion of females were also risk factors for MSDs.

These risk factors, combined with the physical and work organisation risk factors, place this population at increased risk of injury.

The project highlighted that the cleaning industry's current management of OHS and specifically MSDs needs immediate attention and improvement. With the current conditions in the cleaning industry, any expectation of improvements in productivity without significant changes in work organisation, the work environment or equipment would be unrealistic and would be placing cleaners at unnecessary risk of sustaining a MSD. The areas where significant improvements could be made in reducing the risk of MSDs are in work organisation and the equipment provided to cleaning workers.

However, before the risks associated with MSDs can be managed in the cleaning industry, improvements in OHS systems need to be made in all sectors that employ or contract cleaning workers. Therefore, the recommendations made in this report are based on a systematic approach where changes need to be made at all levels, as each has influence on the ability to increase or decrease the risk of cleaning workers sustaining MSDs. Recommendations have been made for:

- WorkCover
- Government departments
- Employers
- Property owners and managers
- Designers and equipment manufacturers and suppliers
- Workers

Furthermore, specific recommendations have been made on how to reduce risks associated with the cleaning tasks assessed in this study. These include in the evidence based guide that incorporates information on risk assessments, controls and case studies. The evidence based guide provides a brief summary of the current literature on MSD risks and injury prevention, and includes the findings from this study, with advice about the 'high risk' and 'low risk' approaches. The evidence based guide does not include "caution zones" or "threshold limits" as the most current literature does not recommend these and explains that these are impossible to provide for MSDs due to the complex interaction of the large number of different risk factors.
1. Background

1.1 Introduction to the project

The Workplace Safety Summit 2002 identified and recommended the need to review design and other factors, which contributed to musculoskeletal injury and occupational overuse syndrome (OOS) in the Cleaning Industry (WorkCover 2002a).

At the Summit: "The working group...discussed musculoskeletal injury and occupational overuse for the Cleaning Industry...the high risk of injury associated with having to clean large surface areas, in reduced timeframes, due to productivity savings".

In response to this recommendation, WorkCover NSW established a Steering Committee comprising representatives from WorkCover, LH MU, Building Service Contractors Association of Australia (BSCAA), NSW Cleaning Industry and independents (an academic and medical practitioner). The Steering Committee administered commissioned research into quantifying the upper limb demands of repetitive manual tasks performed by cleaners - an area not previously investigated in any depth in Australia.

In September 2004, WorkCover NSW appointed Health & Safety Matters Pty Ltd to undertake this research.

The objectives of the project were to:

- a) Explore the impact of upper limb musculoskeletal disorder injuries amongst cleaners;
- b) Describe the physical and work organisational demands of the upper limb work in cleaning;
- c) Develop an evidence-based guide to be used in conjunction with risk assessment checklists in the manual handling codes to enable an objective valid and reliable assessment of upper extremity work is performed; and
- d) Develop with industry, case study examples of risk assessment to address hazards commonly faced by general cleaning.

In response to identified needs areas, the following industry sectors were nominated by the Steering Committee to be addressed through the research project:

- "government utilities (eg schools);
- commercial office space;
- commercial recreational facilities (Clubs, Hotels/Resorts etc); and
- commercial residential (Motels etc).

In addition, the Steering Committee requested that the most repetitive cleaning tasks be assessed as a priority.

The project incorporates the NSW legislative requirements including using a risk management approach, consulting with the employees, and considering each organisation's 'duty of care' under the OHS Act 2000. For guidance the project utilises the National Standard for Manual Handling and the Code of Practice for Manual Handling (NOHSC 1990), and the Code of Practice for the Prevention of Occupational Overuse Syndrome (NOHSC 1994), while also referring to the new Draft National Standard and Code of Practice for the Prevention of Musculoskeletal Disorders (MDS) from Manual Handling at work (NOHSC 2004).

A range of approaches was used to gather sufficient quantitative and qualitative data to meet the project objectives. These included the consideration of biomechanical, psychophysical, physiological and epidemiological data. The main emphasis was on the biomechanical, psychophysical and epidemiological approaches. The explanations of each of these methods are provided in Table 1.

<table>
<thead>
<tr>
<th>Approach</th>
<th>Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biomechanical</td>
<td>Focusses on the compressive and shear forces, moments and reactions on</td>
</tr>
<tr>
<td></td>
<td>the joints and body structures at different angles used in manual handling</td>
</tr>
<tr>
<td>Physiological</td>
<td>Uses metabolic load limitations such as oxygen consumption, heart rate</td>
</tr>
<tr>
<td></td>
<td>and fatigue, and can also use the measurement of intra-abdominal pressure</td>
</tr>
<tr>
<td>Psychophysical</td>
<td>Based on peoples' advice and opinions regarding how they feel and what</td>
</tr>
<tr>
<td></td>
<td>they find is acceptable, eg as maximum loads.</td>
</tr>
<tr>
<td>Epidemiological</td>
<td>Uses workplace risk factors and injury patterns together with personal</td>
</tr>
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<td></td>
<td>risk factors to determine the level of risk</td>
</tr>
</tbody>
</table>

The project was conducted in a year of pending changes to major NSW government cleaning contracts and industrial action by cleaners working on these contracts, and consequently needed to be sensitive to the industrial climate. The cleaners' industrial action was to highlight their concerns about planned changes to the NSW government’s cleaning contracts which they feared may reduce the number of cleaners employed, reduce the number of hours worked per cleaner, and reduce occupational health and safety (OHS) activity in the industry (Owens 2004). An ongoing but increasing concern reported by the cleaners' union in NSW is the demands by cleaning companies for increased productivity and faster cleaning rates by cleaners, particularly in schools (LH MU 1999; LH MU 2004).

This project therefore aimed to address the concerns of each of the stakeholders by objectively reviewing the current state of the cleaning industry in NSW in relation to repetitive manual handling tasks and the risk of upper limb musculoskeletal disorders (MSDs), providing advice about how to reduce the risks, and also considering how improvements in productivity could be achieved.

1.2 Cleaning workers

1.2.1 The workforce

There are approximately 92,000 cleaners in Australia, making up 1% of employed persons (ABS 2003), and 35,000 cleaners in NSW (BSCAA 2004). Typical work in the industry is providing 'general cleaning services' such as routine vacuuming, dusting and waste collection (ABS 2001). In addition to the specific occupational group of 'cleaners' as defined by occupational coding (ABS 1997), there are many other workers in Australia whose role includes selected cleaning tasks, and this project also briefly investigates the common...
cleaning tasks undertaken in commercial residential and commercial recreational facilities by
Rozen Attendants and other workers in the hospitality sector. Socioeconomically, cleaners are
one of the lowest paid occupational groups in Australia (ABS 2002).

A detailed analysis of the cleaning industry in 1988-89 (ARDS1999) revealed that the total
income from this industry was $2137 million, with an operating profit margin of 7.3%. Labour
costs were estimated at 70% of total expenses. The largest sector for income was from
cleaning commercial buildings and offices (accounting for approximately 42% of income),
followed by cleaning educational premises (accounting for 16% of income) and retail premises
(accounting for 15% of income).

The peak cleaning industry representative bodies in Australia are the Building Service
Contractors Association of Australia (BSCAA) and the Australian Cleaning Contractors' 
Association Inc (ACCA). The NSW branch of BSCAA consists of 94 member companies
which reportedly represent over 80% of the NSW market, and ACCA specialises in small to
medium-sized businesses.

According to the BSCAA (2004), there are a very small number of 'large' cleaning businesses
in NSW (employing more than 100 cleaners) with typical cleaning businesses being either
small (5 to 20 employees) or micro (less than 5 employees). This data is consistent with ABS
data showing less than 2% of Australian cleaning companies employ more than 100 persons,
but these large businesses account for 52% of all cleaning industry employment (ABS 2002).

More recent data regarding property and business services show that this sector is one of the
fastest growing with a 35% increase in employment in the period 1995 to 2000, representing
the third biggest employing industry sector (ABS 2003). According to the LIHMU (1999) there
is an increasing number of small and franchised cleaning businesses, and an increasing rate
of sub-contracting in Australia.

In NSW the contract for cleaning the 3,200 government owned facilities (such as schools,
technical colleges, government departments, libraries etc) was worth $762 million in the year
2000 (NSW Legislative Assembly Hansard 2000). Approximately 6,800 cleaners are currently
working at these government sites under 3 large cleaning companies who were awarded the
contracts in 1999 (Cook 2004).

1.2.2 Workplace injury and disease in cleaners

Although cleaners represent just 1% of the working population (ABS 2002), they show high
rates of injury and disease. Cleaners as an occupational group have a frequency rate of 23.1
for all injuries, as compared with the 'all occupations' rate of 10.5 (rate per million hours
worked), and an incidence rate of 25.6 as compared with all occupations rate of 17.7 (rate per
thousand employees) (NOHSC 2003). These figures are summarised in Table 2.

The main mechanism of injury in cleaners in NSW is body stressing, accounting for 45% of all
claims in the past 10 years (WorkCover NSW 2002b), and this typically results in the
development of a musculoskeletal disorder. Body stressing is classified as including:

- Muscular stress while lifting, carrying or putting down objects
- Muscular stress while handling objects other than lifting, carrying or putting down
- Muscular stress with no objects handle
- Repetitive movement, low muscle loading

(NOHCSC 2003)

Musculoskeletal disorders in cleaners represented 4% of total workers compensation claims in
Australia in 2001/02 (NOHSC 2003). Interestingly this figure is equal to the cases for
musculoskeletal disorder in the Construction and Mining Industries for the same period and
with the same number of people employed in the industry. As compared with frequency rates
of musculoskeletal disorders in all other occupations, cleaners have almost three times the
average rate (cleaners – 1.1; all occupations – 0.4) (NOHSC 2003).

Table 2 – Comparison of injury rates

<table>
<thead>
<tr>
<th>Injury rates</th>
<th>Cleaners</th>
<th>All occupations</th>
</tr>
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<tbody>
<tr>
<td>Injury frequency rate (all injuries)</td>
<td>23.1 injuries</td>
<td>10.5 injuries</td>
</tr>
<tr>
<td>Injury incidence rate (all injuries)</td>
<td>25.6 injuries</td>
<td>17.7 injuries</td>
</tr>
<tr>
<td>Musculoskeletal disorder frequency rate</td>
<td>1.1 injuries</td>
<td>0.4 injuries</td>
</tr>
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</table>

The high rate of injury in the cleaning industry is clearly demonstrated by the Insurance
Premises rate in NSW (WorkCover 2004). According to the premium rates, workers in
Cleaning Services for government cleaning contracts are at greater risk than workers in
mining, demolition, and abbatoirs, and the cleaning services are more than 4 times as
dangerous as pest control services. Table 3 provides a summary of selected premium rates.

Table 3 – Insurance Premium Rates in NSW

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Cleaning Services (NSW Government Contract)</td>
<td>19.60%</td>
</tr>
<tr>
<td>Demolition work</td>
<td>12.44%</td>
</tr>
<tr>
<td>Abbatoirs</td>
<td>12.00%</td>
</tr>
<tr>
<td>Underground mining (coal, zinc, copper)</td>
<td>11.45%</td>
</tr>
<tr>
<td>Cleaning Services (non-Government Contract)</td>
<td>76.89%</td>
</tr>
<tr>
<td>Pest Control Services</td>
<td>5.49%</td>
</tr>
</tbody>
</table>
2. Musculoskeletal disorders and cleaning work

2.1 Musculoskeletal disorders

2.1.1 Definition and explanation

Musculoskeletal disorders have been defined in Australia as:

- "injuries that affect the bones, joints, muscles and tendons, and nerves of the human body. Musculoskeletal disorders can occur suddenly or over a prolonged period of time. Common types of musculoskeletal disorders are:
  - Sprains and strains;
  - Injuries to muscles, intervertebral discs and other structures in the back;
  - Injuries to soft tissues such as nerves, ligaments and tendons in the wrists, arms and shoulders."

(NOHSC 2004)

Musculoskeletal disorders in the upper limbs develop from a wide range of factors that are generally grouped as:

- physical factors;
- work organisation and psychosocial factors; and
- individual factors.

A summary of risk factors contributing to the development of work related musculoskeletal disorders are provided at Table 4.

As musculoskeletal disorders are generally caused by a combination of different factors, they are commonly referred to as being 'multi-factorial' in nature (Sluiter et al 2001).


<table>
<thead>
<tr>
<th>Physical Risk Factors</th>
<th>Work Organisation and Psychosocial Risk Factors</th>
<th>Individual Risk Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task factors:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repetition</td>
<td>Job demands</td>
<td>Age</td>
</tr>
<tr>
<td>Weight</td>
<td>Job control</td>
<td>Gender</td>
</tr>
<tr>
<td>Pressure</td>
<td>Job support and social relations</td>
<td>Pre-existing musculoskeletal disorders</td>
</tr>
<tr>
<td>Vibration</td>
<td>Satisfaction and importance</td>
<td>Skills and experience</td>
</tr>
<tr>
<td></td>
<td>Sodoeconomic status</td>
<td></td>
</tr>
<tr>
<td>Work environment</td>
<td></td>
<td></td>
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<tr>
<td>Work equipment</td>
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</table>

Terminology for these disorders has changed over the past 20 years, with earlier titles moving out of favour by many health practitioners and researchers due to their narrow definition. For example, the terms repetition strain injury (RSI), occupational overuse syndrome (OOS), and cumulative trauma disorder (CTD) reflect the notion that repetition and overuse are the key factors resulting in injury or disease, and this may serve to perpetuate the notion that disorders are only the result of physical factors.

To be consistent with current international and national researchers and most OHS jurisdictions, the term musculoskeletal disorders and the abbreviation 'MSD' will be used in this report. To identify upper limb musculoskeletal disorders the term 'upper limb MSD' will be used. The term musculoskeletal disorder (MSD) reflects the current knowledge that exposure to a combination of these various factors (physical, work organisation/psychosocial and individual) can result in physiological changes in the worker's body and subsequent injury and disease processes. Injury is rarely the result of exposure to one risk factor or one event.

Burgess—Limerick (2003) summarises the injury and disease process related to physical loading as follows:

- "Acute injuries are associated with a relatively short exposure to loads which exceed tissue tolerance."
- "Cumulative injuries ... occur as a consequence to relatively long term exposure to load ... (and) the general mechanism of injury is ... an accumulation of microdamage which exceeds the tissue's capacity for repair."
- "Injuries may also occur as a combination ... where a history of cumulative loading leads to reduced tissue tolerance, which is then exceeded by short term exposure to a relatively high intensity load".

Symptoms that may result from this injury or disease process include:

- pain;
- stiffness;
- tingling;
- clumsiness;
- loss of coordination;
- loss of strength;
- skin discolouration;
- differences in temperature; and

Some of the specific diagnoses given to upper limb MSDs (Sluiter et al 2001) include:

- Rotator Cuff Syndrome;
- Epicondylitis – lateral and medial;
- Nerve compression syndromes (eg Carpal tunnel syndrome, Cubital tunnel syndrome, Radial tunnel syndrome, Guyon canal syndrome);
- Peritendinitis;
- Tendovaginitis;
- De Quervain's disease;
- Raynaud's phenomenon; and


- a number of non-specific MSDs.

According to WorkCover NSW data, sprains and strains remain the largest reported injury group accounting for 64% of all workplace injuries in NSW in 2000/01, and 70% of costs (WCA 2002).

For the disorder to be considered work-related, the symptoms should begin, recur or worsen with work (Sluiter et al 2001). Determining the work-relatedness of MSDs can be difficult due to the wide range of factors that can all contribute to or cause the disorder, as well as interaction among a combination of occupational and non-occupational factors.

To prevent or reduce the occupational risk factors in MSDs, governments and industries have been investigating various risk management methods to guide them in injury prevention. The use of guidance material such as caution zones and threshold limit values for manual tasks have been explored, and these are described below.

### 2.2 ‘Caution Zones’ and ‘Threshold Limit Values’

#### 2.2.1 Definition and explanation

The term ‘caution zone job’ appears to have developed in the United States when the Ergonomics Rule was proposed to the Federal Government there (OSHA 1999). In this proposed Rule, caution zone jobs were defined as jobs where a worker’s typical work activities included any one of the following physical risk factors: awkward postures, high hand forces, highly repetitive motions, repeated impacts, heavy, frequent or awkward lifting, and moderate to high hand-arm vibration. Employers who identified that their workers were exposed to any of these risk factors listed in the ‘caution zone’ were to conduct a thorough assessment of the job and then reduce the relevant risk factors.

Threshold Limit Values (TLVs) are exposure guidelines developed by the American Conference of Governmental Industrial Hygienists (ACGIH) to assist industrial hygienists in making decisions regarding safe levels of exposure to various hazards found in the workplace. A TLV reflects the level of exposure that the typical worker can experience without an unreasonable risk of disease or injury. TLVs are available for chemicals as well as physical agents such as cold stress, hand-arm (segmental) vibration, whole-body vibration, heat stress and heat strain, ionizing radiation and noise.

Over the last few years there has been much investigation and debate regarding the provision of caution zones and threshold limits for manual handling activities (OSHA 1999; Burgess-Limerick 2003, Bottomley 2003a; Government Ergonomics Network 2002; Caple 2003). The provision of specific ‘limits’ for whole tasks or for the various risk factors could assist industry by simplifying risk assessment and risk control as well as guiding OHS jurisdictions in enforcement activities.

However the recommendations from all of the most recent investigations are that no specific ‘limits’ or ‘safe amounts’ can be provided for musculoskeletal disorders.

These internationally recognised experts in MSDs conclude that it is not possible to provide specific quantitative measures for manual tasks due to the complex and multi-factorial nature of the development of manual handling injuries and diseases. As Burgess-Limerick (2003) advised Australia’s National Occupational Health and Safety Commission (NOHSC):
action may result in the problems not being properly managed and resolved (Government Ergonomists 2003). As they reported to Australia’s National Occupational Health and Safety Commission (NOHSC):

"Manual handling is a complex area.......there is a limit to how far we should 'dumb down' the Code."

(Referring to the draft plans for the new National Standard and Code of Practice for the Prevention of Musculoskeletal Disorders (MSD) from Manual Handling at Work (NOHSC 2004).

The authors above argue that companies and OHS jurisdictions need to acknowledge that for some OHS issues (including manual handling), specialist expertise should be sought. Many of the assessment and interpretation methods require specialist training, together with a solid background in ergonomics, health, safety and/or the behavioural sciences.

A review of the current knowledge of all of the risk factors for work related MSDs, including upper limb MSDs, is provided below.

2.3 Physical risk factors

2.3.1 Definition and explanation

Physical risk factors for work-related MSDs include:
- the physical demands of the task;
- the physical work environment; and
- the design and use of the work equipment.

A comprehensive survey undertaken for the National Institute for Occupational Safety and Health (NIOSH) in the United States analysed 600 studies for causal relationships between work-task factors and the development of MSDs (Bernard 1997). This survey identified that the key risk factors for work-related upper limb MSDs were force, posture, repetition, vibration and/or a combination of these factors. A summary of the evidence is provided in Table 5.

### Table 5 - Evidence for the correlation between physical work-related factors and upper limb MSDs (OSHA 1999)

<table>
<thead>
<tr>
<th>MSD Location or Diagnosis</th>
<th>Number of Studies</th>
<th>Risk Factors</th>
<th>Force</th>
<th>Posture</th>
<th>Repetition</th>
<th>Vibration</th>
<th>Combination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neck &amp; shoulder</td>
<td>&gt; 45</td>
<td>++</td>
<td>+++</td>
<td>++</td>
<td>++</td>
<td>+/0</td>
<td>(-)</td>
</tr>
<tr>
<td>Shoulder</td>
<td>&gt; 20</td>
<td>+/0</td>
<td>+++</td>
<td>+/0</td>
<td>++</td>
<td>+/0</td>
<td>(-)</td>
</tr>
<tr>
<td>Elbow</td>
<td>&gt; 20</td>
<td>++</td>
<td>+/0</td>
<td>++</td>
<td>++</td>
<td>+/0</td>
<td>(-)</td>
</tr>
<tr>
<td>Carpal tunnel</td>
<td>&gt; 20</td>
<td>++</td>
<td>+/0</td>
<td>++</td>
<td>++</td>
<td>+/0</td>
<td>(-)</td>
</tr>
<tr>
<td>Hand/wrist/ankle</td>
<td>&gt; 20</td>
<td>++</td>
<td>+/0</td>
<td>++</td>
<td>++</td>
<td>+/0</td>
<td>(-)</td>
</tr>
</tbody>
</table>

Similar studies from Europe have also identified these physical risk factors as contributing to work related upper limb MSDs (Health Council of the Netherlands 2000; Buckle & Devereux 2002).

There have been a number of studies from around the world that have identified a high rate of musculoskeletal and other disorders in cleaners and have explored the specific risk factors contributing to these disorders (Woods et al 1999; Sjögren et al 2003; Landstad; Schuld et al 2001; Gammelcians et al 2003; Nordandor et al 2000; Leigh & Miller 1997; OSHA 1997; Landstad, Eckholm et al 2002; Pierre-Jerome et al 1998; Tuovinen et al 1993; Jonsson, 1989).

The studies have included analysis of the postural and muscular demands of the tasks via surface electromyography, local pressure pain thresholds, posture surveys, force handles, ratings of perceived exertion (Larsson et al 2002; Person et al 2003; Laursen et al 2003; Sogaard et al 2001; Nordander et al 2000; Jonsson 1998; Johansson & Ljunggren 1985; Acklin & Cerracas 1998) and some earlier studies included a wide range of measures (Sogaard et al 1996; Winkel et al 1998; Hagstrom & Husgberg 1969).

Other physiological measures investigated in the cleaning research have included the cardiovascular and oxygen demands in selected cleaning tasks as measured by blood pressure, oxygen uptake, heart rates, metabolic rates and ratings of perceived exertion (Baigi et al 2004; Norman et al 2003; Andrew et al 1998; Gunn et al 2007; Bassett et al 2000).

Results from these studies into cleaning tasks and cleaners illustrate that many common cleaning tasks require people to work in awkward postures while also working with high cardiovascular loads and with their muscles working under high, median, static and peak loads. Fatigue and pain were common complaints in most of these studies. The main areas of the musculoskeletal system that were under stress were the back, shoulder girdle, neck, and upper limbs. These studies highlight a number of risk factors that are all strongly associated with the development of MSDs:
- working in awkward postures;
- working under high static load;
- doing repetitive work;
- using high forces;
• working with vibration; and
• combinations of these factors (OSHA 1999).

Cleaners with a history of a MSD have been found to have developed microscopic changes in their musculoskeletal anatomy and physiology. For example studies investigating shoulder girdles and the upper trapezius muscle identified different muscle fibre structures and electromyographic responses in cleaners with a history of shoulder girdle pain compared with cleaners without a history of shoulder girdle pain. They also noted a correlation with tender points in the cleaners’ trapezius muscles (Larsson et al 2002; Larsson et al 2001; Larsson, Bjork & Henriksson et al 2000).

Another study of cleaners with shoulder pain showed increases in pain thresholds and fatigue after muscular exertion (Norman et al 2003). Damage to the function of nerves in the carpal tunnel of cleaners’ wrists has also been identified. Researchers found that in a random sample of healthy cleaners and healthy non-cleaners, the cleaners’ median nerves had poor electrophysiological function (Pierre-Jerome et al 1998).

These anatomical and physiological changes can have a direct impact on cleaners’ work ability and future health. For example, studies of shoulder muscles showed that cleaners with shoulder pain had reduced endurance in the muscles and higher levels of perceived exertion. There was also a reduction in the ability to relax the muscles, and this was considered to be indicative of future insufficiency in these muscles (Larsson, Bjork, Elert et al 2000).

2.3.2 Impact of the work environment

The design and layout of the work environment is a well known factor that can create or contribute to the high physical demands of jobs. A study by OSHA (1999) reported that cramped work areas resulted in workers adopting twisted and bent postures, and furniture and fixtures that required awkward postures or excessive force to move. To reduce these risks, workplace modification should be an integral part of an injury prevention program (Westgaard & Winkel 1997).

In past research into the cleaning industry there has been generally only minimal examination of the design and layout of work areas and the impact on risks for cleaners, with at best a brief overview of the typical features of the environments. Many studies were laboratory based so did not simulate all of the features of the cleaners’ normal work environments. However some field-based studies have considered the environment, identifying the increased risk of shoulder and back injuries when cleaners need to work in cramped work areas and need to move furniture in order to clean (Messing et al 1998; Woods et al 1999; Johansson & Ljunggren 1989). The movement of furniture in these studies was typically done one-handed as the cleaner held the vacuum or mop with the other hand, and the furniture was often heavy or awkward to move.

Only one study outlines how soft furnishings and fixtures influenced cleaning requirements, methods, and air quality (Smedje & Norback 2001). This study based on 181 schools in Sweden, found that classrooms with more fabrics resulted in more settled dust, and classrooms with chalkboards had more dust than those with whiteboards. The study also noted high levels of dog and cat allergens (as about one quarter of children kept pets at home), respirable dust, bacteria, moulds, settled dust, formaldehyde and volatile organic compounds.

In this school study, the measurable pollutants varied according to cleaning method and surfaces. Wet mopping increased the airborne concentrations of viable bacteria, while dry mopping was related to more settled dust. Recommendations were made for cleaning chairs and desks more regularly as this furniture had the highest concentration of animal allergens, and the study concluded that furnishings and textiles were all reservoirs of different irritants and allergens and so affected indoor air quality for everyone at the schools. It is not known how cleaning requirements are determined for Australian schools.

A NSW study based at schools and technical colleges also commented on risks within the environment, including poor access to commonly used equipment (such as industrial waste bins, cleaning equipment etc). difficult access within buildings, lack of storage, cluttered workspace, poor lighting, exposure to heat, cold and noise (Gaudry 1998). A NSW study into wet mopping also noted the impact of the environment on risk, with work postures changing from upright in open areas to twisted and stooped in confined areas such as toilets or around furniture (Paver et al 1997). Remedial actions taken since these problems were identified are not known.

2.3.3 Equipment

A recent study in the United Kingdom has provided a very detailed analysis of common cleaning equipment (for wet mopping, floor buffing, and vacuuming) based on expert assessment, worker surveys, focus groups, and workplace and laboratory assessments (Woods et al 1999; Woods & Buckle in press 2004). From these assessments they found:

... a number of inadequacies in the design of commonly used cleaning equipment that result in:
• Extreme, static or constrained postures
• Repetitive movements
• Heavy workload and
• High force requirements

(Woods & Buckle in press 2004)

The report further noted that much of the cleaning equipment used was not well suited to either the task or the user. Consequently, the report provides practical suggestions for equipment selection and design to reduce injury and assist with worker comfort.

An earlier project undertaken for the WorkCover NSW BackWatch program investigated the range of wet mopping equipment and undertook expert comparisons for ease of use and to assist in reducing effort and improving posture and safety (Paver et al 1997). This included postural analysis of cleaners undertaking mopping in different work settings. This study also found that mop size, bucket design, handle length and other factors affected the cleaners’ technique, posture, fatigue, speed and general work comfort. A WorkCover publication provided a summary of the report’s recommendations so that industry and the cleaners could benefit from this work (WoodsCover 1998).

A study of cleaners at NSW schools and technical colleges (Gaudry 1998) criticised the equipment used by the contractors stating much was:

"outdated and unsuitable" and was "compound by poor maintenance systems".

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Report prepared by Health & Safety Matters Pty Ltd, February 2005
2.4 Work organisation factors

2.4.1 Definition and explanation

The National Institute of Occupational Safety and Health in the USA (NIOSH) in a recently developed model by Landsbergis (2003) suggests that 'work organization' (sic) includes three different, but related contexts:

1. The external context - including the economic, legal, political, technical and demographic features at a national and international level;

   Many examples were given to illustrate these points. A lack of equipment on the sites was also identified, with survey respondents reporting the need to carry heavy equipment up and down stairs, including pulling floor polishers reported to weigh 45kg. Another study based at NSW schools also reported on problems with equipment, noting the need for additional equipment to reduce exertion, improve posture, while also assisting with productivity (Aickin & Carrasco 1998).

   Many studies conclude that there appears to be:
   a lack of assessment and trial of equipment prior to purchase;
   a lack of consultation with the users;
   unsuitable or non-existent maintenance and replacement schedules; and

   Despite the researchers' concern to improve equipment, they all caution that physical risk factors are just one aspect of work, and Woods and Buckle (in press 2004) explain that:

   "Concentrating only on physical work ergonomic factors may not achieve as much benefit in terms of a reduction in sickness rates/musculoskeletal ill health as a more holistic approach that also takes account of work organisational risk factors."

2.3.4 Summary

The current research into cleaning work both overseas and in Australia has confirmed that the physical demands of cleaning work present a number of risk factors known to contribute to injury and disease, including specific risks for the development of upper limb MSDs. In addition, there is clear evidence of microscopic changes and damage in cleaners’ musculoskeletal structures, and these changes often contribute to disability and pain in these workers.

As well as identifying physical and work site design factors, many reports also highlighted the importance of psychosocial factors in the development of MSDs, and in particular work organisation and psychosocial factors (Landsbergis 2003; Health Council of the Netherlands 2000; Buckle & Devereux 2002; Devereux et al 2004). These work organisation and psychosocial factors are described below.

The organisation of work can have an important impact on stress-related health outcomes such as cardiovascular disease, musculoskeletal disorders and psychological disorders. The current Australian Code of Practice for Manual Handling (NOHSC 1990) lists work organisation as a potential risk factor for the development of MSDs, and it defines this as:

• staffing levels;
• availability of equipment;
• work schedules;
• shift work;
• work-pace;
• task variety;
• rest breaks;
• recovery time; and
• work procedures.

Other definitions of work organisation use this term synonymously with ‘psychosocial factors’.

In the past, risk factors for work-related MSDs have been viewed predominantly from a physical perspective, with minimal consideration of the work organisation and psychosocial factors. However recently published studies based on extensive reviews of the literature now provide detailed lists of the work organisation and psychosocial factors that contribute to the risk of work related MSDs, including injuries to the upper limbs (Devereux et al 2004; Landsbergis 2003). A summary is provided in Table 6.

Table 6. Work organisation and psychosocial factors contributing to MSDs (adapted from Devereux et al 2004 & Landsbergis 2003)

<table>
<thead>
<tr>
<th>Risk factors</th>
<th>Specific problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work demands</td>
<td>P poorly designed or managed workload</td>
</tr>
<tr>
<td></td>
<td>Poor work scheduling with insufficient time for recovery</td>
</tr>
<tr>
<td></td>
<td>Poorly designed job</td>
</tr>
<tr>
<td></td>
<td>Increased job intensification</td>
</tr>
<tr>
<td></td>
<td>Increased overtime</td>
</tr>
<tr>
<td></td>
<td>High workload</td>
</tr>
<tr>
<td></td>
<td>Time pressures</td>
</tr>
<tr>
<td>Job control</td>
<td>Lack of skill discretion</td>
</tr>
<tr>
<td></td>
<td>Lack of authority</td>
</tr>
<tr>
<td></td>
<td>Lack of autonomy</td>
</tr>
<tr>
<td></td>
<td>Minimal control over rest break timing and duration</td>
</tr>
<tr>
<td>Job support</td>
<td>Lack of appropriate proactive and reactive support at work</td>
</tr>
<tr>
<td></td>
<td>Failure to match people's skills with that job</td>
</tr>
</tbody>
</table>

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Final Report – Assessment of the Repetitive Manual Tasks of Cleaners

<table>
<thead>
<tr>
<th>Relationships</th>
<th>Poorly designed or managed procedures for eliminating damaging conflicts at individual/team level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>supervisor, colleagues and/or management</td>
</tr>
<tr>
<td>Role conflict</td>
<td>Inappropriate levels of role ambiguity</td>
</tr>
<tr>
<td></td>
<td>Inappropriate levels of responsibility</td>
</tr>
<tr>
<td>Change</td>
<td>Lack of a planned or active strategy for change</td>
</tr>
<tr>
<td></td>
<td>Poorly designed or managed strategies for overcoming resistance</td>
</tr>
<tr>
<td></td>
<td>Lack of appropriate consultation with employees over change</td>
</tr>
<tr>
<td></td>
<td>Lack of appropriate support for new employees</td>
</tr>
<tr>
<td></td>
<td>Poorly designed or managed ways of working with new technology</td>
</tr>
</tbody>
</table>

Features of good work organisation

According to Landsbergis (2003) the work organisational and psychosocial factors that have been associated with lower injury rates are:

- Empowerment of the workforce
- Good relations between management and workers
- Autonomy
- Efficiency
- Delegation of control
- Low stress
- Low grievance rates
- Encouragement of long-term commitment of the workforce

Cleaning jobs that permit flexibility in the selection of cleaning tasks and do not have strictly proportioned work areas and time schedules have also been found to reduce physiological job strain and reduce absenteeism (Hopsu & Louhevaara 1991.)

2.4.2 Job demands, job stress and job support

One of the most cited investigations into work organisation and psychosocial issues and upper limb MSDs concluded that high job demands and high levels of job stress lead to an increased incidence of MSDs (Bongers et al 1993). Other subsequent research found that after physical demands were taken into account, psychosocial factors had an effect on these MSDs, and this effect was believed to be completely independent of physical factors (Ronnard 1997).

A systematic review into psychosocial risk factors and neck pain also identified that high job demands, low socio-economic worker support, poor job control, high and low skill discretion, and low job satisfaction were associated with high levels of neck pain and disability (Arians et al 2001). Studies specifically with cleaners have highlighted the same association between the psychosocial and work organisation factors and muscle tension in the neck and shoulder (Toivanen et al 1993).

The task characteristics outlined by the above studies are typical aspects of occupations (such as cleaning), which are commonly perceived to be low status jobs. Studies of overall population health have highlighted the relevance of socioeconomic status to general health status, with lower socioeconomic groups presenting with greater health issues (Marmot 1994). The situation is put succinctly by Lundberg (1999), who stated: "Conditions typical of many low status jobs, such as time pressure, lack of influence over one's work, and constant involvement in repetitive tasks of short duration are known to cause work stress or strain."

To summarise the interaction of physical and non-physical factors in the development of work-related MSDs, researchers developed a simple model, as illustrated in Figure 1 (Bongers et al. 2002).

Recent Australian studies have also examined the interaction of physical factors with non-physical factors, specifically work-related stress (WERC 2003a). Work related stress was found to be both a hazard for the development of musculoskeletal disorders and also the outcomes of exposure to other workplace hazards such as high physical demands. This stress response in individuals includes physiological changes, behavioural changes and negative feelings. Each of these factors, either singly or combined, can increase the risk of developing upper limb MSDs.

Lack of support at work is another factor contributing to MSD, and good support has the reverse affect. A study of cleaners and their support at work showed the significant and positive impact that personnel support has on preventing or reducing absenteeism from MSDs (Landstad, Vinberg et al 2001). The results were particularly marked for cleaners with a previous history of high absenteeism. The interventions found to improve the clinical presentation of these cleaners with MSDs included: various occupational organisational measures; changing the psychosocial working environment; developing the cleaners' competencies at work; and individual rehabilitation programs (Landstad, Schulte et al 2001).
In studies where cleaning workers have been actively involved in negotiating their work rates and other aspects of their work, this involvement has achieved a positive effect on the working conditions and on the workers' health (Leo & Krause 2002; Carnivale et al 2003).

This research demonstrates that work demands, support and performance related issues are much more important as workplace stressors than individual personality or non-work factors, particularly in relation to 'manual handling' work (WERC 2003b).

2.4.3 Employment characteristics that impact on the risk of MSDs

Precarious employment

Certain work arrangements can also be risk factors for MSDs for workers in industries such as cleaning and hospitality. Internationally and nationally, there is a move away from direct employment to one of subcontracting. As an employment sector, micro, small and medium sized businesses are growing, as large businesses are outsourcing and subcontracting their cleaning work (Stromberg 1988; Capil 2003; European Agency for Safety and Health at Work 2002; Benavides et al 2003). These industries are typified by providing 'precarious employment' options for workers as the work is usually project or contract based, can be part time, temporary, and flexible in nature.

An Australian study examined the interaction of these workforce and employment patterns, investigating risks associated with precarious employment and the changes in job and work conditions (WERC 2003a). The risks associated with these changes are summarised in Table 7. Cleaning contracts in NSW reportedly range from month-to-month arrangements to longer contracts of 5 years or more. As such, many of these jobs would be considered 'precarious' employment and associated with feelings of job uncertainty and/or insecurity when contracts are due to expire or change hands.

Benavides at al (2000) investigated the associations of types of employment with health outcomes in the European Union. They found that precarious employment was consistently and positively associated with musculoskeletal symptoms and job dissatisfaction.

Table 7 – Employment and workforce characteristics influencing MSDs

<table>
<thead>
<tr>
<th>Emerging Issues</th>
<th>Factors that Influence MSDs</th>
</tr>
</thead>
</table>
| Precarious employment - defined as the increasing numbers of temporaries, casuals, shift workers, self-employed and multiples job holders in Australia | • Economic and reward risk factors  
• Work disorganisation risk factors  
• Increased likelihood of regulatory failure |
| Changes in job and work conditions   | • Longer working hours  
• Risk exposure and dose (severity and duration of exposure)  
• Changing shiftwork patterns  
• Increasing workloads, work intensification, open-ended work demands  
• New technologies and changing tasks demands |
| Worker characteristics               | • Ageing in the workforce  
• Faisilising of the workforce  
• Workers from non-English speaking backgrounds  
• Very young workers |

Small and medium-sized business and OHS

Research in Australia, the United Kingdom and in the European Union has examined the ability of small and medium sized enterprises to manage their OHS obligations (Capil 2003; Mayhew 2002; Vickers et al 2003). The findings of this research highlight poor risk management strategies in the small and medium sized enterprises studied, and higher than average injury rates. Mayhew (2002) listed the problems such as the competitive nature of tenders, projects based on cost, and ignoring OHS as a way to keep costs down. She also pointed out that smaller workplaces have physically fewer OHS resources, and current regulations are designed for large workplaces and are typically inappropriate for small workplaces.

Mayhew and Quitian (2001) also highlighted the problem of reporting of OHS issues in small and medium sized enterprises, whereby employees may not be aware of their rights to workers compensation, and/or fearful of losing their jobs if they report problems. Additionally, some small and medium sized enterprises or micro enterprises may not carry any workers compensation cover, or have insufficient cover. If the worker is a sole trader or self-employed and becomes injured, it is almost impossible to continue the business. As the workers compensation system is the predominant method of determining workplace injuries and diseases in Australia, the prevalence of workplace injury is most probably underestimated.

Vickers et al (2003), in their report for the Health and Safety Executive of the United Kingdom, pointed to: "poor management of risk [rather] than the absolute seriousness of the hazards faced..." as the major problem for small businesses in relation to health and safety. These researchers found that features contributing to poor OHS performance were limited resources, low frequency of regulatory inspections, limited access of workers to representation, and a low impact of adverse publicity for OHS infringements.

Union membership and effect on MSDs

A recent study from the United States of America compared the rate of upper limb MSDs in a random sample of more than 4,000 workers (Morse et al 2003). The study found that injury prevalence rates for workers at both the non-unionized and unionized worksites were comparable, however workers at the unionized sites were eight times more likely to file for workers compensation than at non-unionized sites. This higher rate of filing for workers compensation was found to reflect earlier reporting, reporting of less serious conditions and workers with a better understanding of the work relatedness of their conditions. Non-reporting was associated with workers who were ignorant of their entitlements and were fearful of losing their job and/or not gaining future employment.

The researchers concluded that being a member of a union had an important 'protective effect' on workers for two key reasons. The first was that the union encouraged workers to report, and early reporting and early intervention are key factors in minimising disability and costs (economic and social) of MSDs. The researcher's further identified that assistance from the union resulted in positive OHS outcomes.

2.5 Individual characteristics

2.5.1 Definition and explanation
Individual characteristics refers to the differences between people. Factors that have been identified as affecting the development of upper limb MSDs include:

- Physiological and anatomical differences (and past injuries/disease)
- Age and gender
- Skills and experience

Each of these factors is briefly described below.

2.5.2 Physiology & anatomy

An obvious, yet often neglected factor is that all workers are different, and these differences impact on work ability. This includes observable differences in height and weight, but also in less obvious features such as microscopic or internal anatomical and physiological differences in muscle fibres, discs, tendons, cartilage, nerves, cognitive areas etc. These differences can make workers more or less susceptible to different MSDs.

A study in orthopaedic clinics in the United Kingdom found that cleaners were over-represented in wrist and forearm MSDs. Further examination revealed that shorter workers were at greater risk of MSDs than taller workers, and this was possibly related to the lack of suitable equipment for shorter workers (English et al 1995).

As previously described in Section 2.3.1, a MSD results in changes to the anatomy and physiology of workers, and these changes have a direct impact on factors such as endurance, perceived exertion, and ability to relax the muscles, and are also indicative of future muscular problems (Larsson, Bjork, Ebert et al 2000; Larsson, Bjork, Hendiksson et al 2000).

2.5.3 Age & gender

Another factor influencing upper limb MSDs is age—an important consideration given Australia’s ageing workforce. In June 2002, people aged over 65 years represented 13% of the population, while those under 15 years represented 20%. Further examination revealed that shorter workers are at greater risk of MSDs than taller workers, and this was possibly related to the lack of suitable equipment for shorter workers (English et al 1995).

As previously described in Section 2.3.1, a MSD results in changes to the anatomy and physiology of workers, and these changes have a direct impact on factors such as endurance, perceived exertion, and ability to relax the muscles, and are also indicative of future muscular problems (Larsson, Bjork, Ebert et al 2000; Larsson, Bjork, Hendiksson et al 2000).

According to recent research in Scandinavia, there is an age-related decline in the physical capacity of workers (Savinainen et al 2004). There is also an increasing rate of MSDs as age increase for both genders (de Zwart et al 1997). Earlier research from one study concluded that a person at 60 years of age has about 80% of the physical capacity of a person at 20 years of age, and that generally the physical capacity of women is 70 to 80% of that of men of the same age (Tuomi et al 1991 cited in Toivanen et al 1993). Researchers demonstrate that the rate of age-related changes is likely to be accelerated by the effects of exposure to physically demanding work and other risks (Ilmarinen & Louhevaara 1994; de Zwart et al 1997). The ability of the spinal discs to withstand spinal loading is also reduced with age (Mital et al 1993).

The Australian workers compensation data bases (NOHSC 2002) show that injury frequency increases with workers over 55 years, and duration of injury-related absences from work increases with increasing age. Workers aged 15-24 had less than 50% of the incidence of claims compared to the 55 years and over age group—and workers in this older age bracket reported five times the incidence of claims as compared to the 15-24 year age bracket. The incidence of disease claims increases with each age group, and this could be explained by long latency periods and the increased accumulated exposure of older workers. This data is consistent with data from the self-assessment survey (ABS 2003) where Australian adults rate their health lower as they age (with less people rating their health as ‘excellent’ or ‘very good’ as they age, with increasing ratings of ‘fair’ or ‘poor’).

Cognitive changes are also a feature of ageing. However a recent report outlines evidence that shows that normal age-related cognitive changes are unlikely to affect work performance adversely except when there are severe time constraints over which the worker has little control (WEERC 2003).

Nielsen (1992) specifically explored the issues of ageing in cleaners, noting that at the time the sample of cleaners in Denmark (1168 cleaners) had an average age of 44, with almost 80% aged 45 years of greater. The author warned that there would be problems for this ageing workforce if the work environment and workload was “not made to fit the work ability of the elderly employees”. This study also noted no significant differences between the ‘young’ and ‘elderly’ cleaners with regards to complaints of the physical workloads—with high complaints from both groups for work postures, heavy lifting, repetitive work, and high work pace. An Italian study also found an increased prevalence of disorders in the elbow, wrist, hand and cervical spine in ageing women cleaners (Vito et al 2000).

Several studies have also examined the impact of gender upon reporting of MSDs. For example, Fredriksson et al (2000), in their longitudinal study of neck/shoulder disorders, found a gender difference in causal workplace factors and MSDs. Women’s reporting of neck/shoulder MSD increased with adverse psychosocial factors, while for men, the reporting increased with greater physical demands and exposure to vibration. Treaster and Burr (2004) conducted a literature review to examine differences between the sexes for upper limb MSDs. They found that women had a significantly higher prevalence of upper limb MSDs compared to men, after taking work risk factors into account. A study of almost 17,000 workers in 21 occupational groups also showed women had significantly higher complaints of pain in the neck, shoulder, elbow and wrist than men, again after controlling for occupation and age (de Zwart et al 2000).

In addition to MSDs, studies have identified higher disability rates and poorer general health in female cleaners than in other groups (including other unskilled occupations), with high rates of diseases of the circulatory system and heart disease (Spengler et al 2003; Gampernerie et al 2003). The researchers hypothesized that factors contributing to this poor health may be imbalances in job strain and effort-reward, anxiety and depression, air pollutants and smoking.
3. Methods

3.1 Injury Data Review

The aim of the first stage of the project was to explore the existing research into work-related MSDs in the cleaning industry within Australia and overseas. This was to ensure that the project was properly focused and did not unnecessarily duplicate information. The first step was to review and analyse industry specific injury data. The following sources of information were reviewed:

- WorkCover NSW (2004), Knowledge management - Statistics Branch

3.2 Literature Review and Investigation of Assessment Tools

Following the injury data analysis, a comprehensive review of the most current evidence regarding upper limb MSDs was undertaken to assist the cleaning industry to properly assess and then manage the risk factors inherent in the industry. The literature review included:

1. Risk factors for the development of work-related upper limb disorders
2. Tools that can be used to measure and assess the extent of these risk factors
3. Recommendations for a tool/s suitable for assessing the risks in cleaning tasks in the cleaning industry in NSW

The following sources of information were searched:

- Medline, OSHROM, Proquest, Cinahl & Psychinfo. A range of key words was used individually and in combination in the searches.
- Internet search using keywords
- Secondary sources (ie reference lists from published articles) to locate further literature

To gain further information on the cleaning industry and associated manual handling issues the following activities were also conducted:

- Consultation with peak bodies in the cleaning industry in Australia (eg the workers' union and industry bodies)
- Consultation with national and state government authorities responsible for OH&S
- Consultation with professional association contacts in ergonomics and OH&S

Given the wide range of factors identified as impacting on the development of upper limb MSDs, it became apparent that the assessment must be suited to measure both the physical work load risks and the psychosocial/work organisational risks. Therefore, several tools were selected to enable the risks to upper limb MSDs to be assessed thoroughly.

3.3 Development of the Cleaners' Survey

The fundamental elements required in any measurement tools include:

- Validity - content, predictability and construct
- Reliability - stable and repeatable results
- Sensitivity - to discriminate between tasks or groups of tasks
- Focus
- Ease of field utilization

(Wilson & Coriell 1994)

Each of these elements was taken into account in the selection of appropriate survey tools and the development of the Cleaners' Survey. In summary, the cleaners' survey comprised 3 sections:

3.3.1 General Information

Section one asked respondents to provide basic demographic information such as:

- Age;
- Self reported height and weight;
- Number of years doing cleaning work;
- Typical number of hours and days worked per week.

Additional questions regarding other jobs and the number of hours worked in these other jobs were also included.

3.3.2 Musculoskeletal Problems

The second section investigated pain and discomfort using the standard Nordic Musculoskeletal Questionnaire (Koumakia et al 1987), which asks for details on reported musculoskeletal problems over the last year. The Nordic Questionnaire has been used extensively in other studies to investigate the prevalence of MSDs, including a large study of cleaners conducted by the Robens Centre for Health Ergonomics (Woods et al 1999). This therefore allowed comparisons against the findings from cleaners in the United Kingdom.
3.3.3 Work organisation and psychosocial issues

Section three of the survey contained questions on work organisational factors and the perceptions of the workers about their jobs. Despite an extensive review of assessment tools to measure work organisation and psychosocial risk factors and their impact on MSD, no one tool was found to be suitable for this population or for the project time frames. A recent review undertaken for NOHSC reported that there was not one properly tested and validated assessment tool (WERC 2003b), however they recommended a few that appeared to be relevant to Australia. Some of the tools proposed by the Work Environment Research Centre (WERC 2003b) and other tools reviewed for this study included:

- Job Diagnostic Survey (Hackman & Oldham 1975)
- Work Environment Scale (Moos 1994)
- Job Content Questionnaire (Karasek et al1985 & 1998)
- Effort-Reward Imbalance (Siegrist et al 2004)
- WEBA instrument (Vaas et al 1996)
- VBBA self-report questionnaire (Van Veldhoven 1987)
- Copenhagen Psychosocial Questionnaire (Kristensen 2001)
- Questions from the General Health Survey (SF-36) were also considered (Ware et al 1992).

However after reviewing these tools, the following limitations became evident:

- Lack of validity for this population (ie cleaners/room attendants)
- Not being available in English, or norms for this population not being available
- Limited reliability data
- Requirement for high level English reading or literacy skills
- Long duration of survey tool (45 minutes to one hour to conduct one survey)
- New and emerging issues were not covered (ie changing employment patterns, workforce ageing, gender issues, minority groups and language issues as were also noted by Hurrell et al in 1998).

Questions from the published survey tools were then used for the basis of the questions, particularly, the Copenhagen Psychosocial Questionnaire (Kristensen 2001), the Job Diagnostic Survey (Hackman & Oldham 1975), and the general health question from SF-36 (Ware et al 1992), questions from the Roben’s report (Woods et al 1998) and from a past Australian study (Gaudry 1998). This allowed comparisons to be able to be made between the different cleaning populations. The final survey used the questions in Table 8 to cover the key issues of interest, and these were read out and shown to workers and they then selected their responses.

Table 8. Survey methods – work organisation and psychosocial issues

<table>
<thead>
<tr>
<th>Issues of interest</th>
<th>Methods used to gather information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Job demands and work rates</td>
<td>Survey question to workers doing cleaning:</td>
</tr>
<tr>
<td></td>
<td>• Do you have to work very fast?</td>
</tr>
<tr>
<td></td>
<td>• Do you have to work very fast? (is it physically demanding)</td>
</tr>
<tr>
<td></td>
<td>• Do you have enough time to do everything?</td>
</tr>
<tr>
<td></td>
<td>• Can others help you if you don’t have enough time?</td>
</tr>
<tr>
<td></td>
<td>Response options: Often, sometimes, never</td>
</tr>
<tr>
<td></td>
<td>Observation:</td>
</tr>
<tr>
<td></td>
<td>• of workers doing cleaning</td>
</tr>
<tr>
<td></td>
<td>Interview:</td>
</tr>
<tr>
<td></td>
<td>• of workers doing cleaning: Open questions regarding typical tasks performed in each shift, estimated duration of each task, task order and comments regarding fatigue or exertion</td>
</tr>
<tr>
<td></td>
<td>• of supervisors or managers: Open questions regarding typical tasks performed in each shift, estimated duration of each task, task order, and methods used to determine work rates</td>
</tr>
<tr>
<td></td>
<td>Record review:</td>
</tr>
<tr>
<td></td>
<td>• Of job descriptions and task lists</td>
</tr>
<tr>
<td></td>
<td>Body map survey</td>
</tr>
<tr>
<td></td>
<td>Fatigue and discomfort were also assessed through the Nordic Musculoskeletal Questionnaire (as described in Section …) as these are also indicators used to measure task demands</td>
</tr>
<tr>
<td>Job control and influence</td>
<td>Survey question to workers doing cleaning:</td>
</tr>
<tr>
<td></td>
<td>• Can you influence the amount of work you are given?</td>
</tr>
<tr>
<td></td>
<td>• Do you have any influence on HOW you do your work? (e.g. order/method)</td>
</tr>
<tr>
<td></td>
<td>• Do you have any influence on WHAT you do at work? (tasks)</td>
</tr>
<tr>
<td></td>
<td>• Can you decide when to take a break?</td>
</tr>
<tr>
<td></td>
<td>Response options: Often, sometimes, never</td>
</tr>
<tr>
<td>Job satisfaction and job meaning</td>
<td>Survey question to workers doing cleaning:</td>
</tr>
<tr>
<td></td>
<td>• Do you feel that the work you do is important or significant?</td>
</tr>
<tr>
<td></td>
<td>• Response options: Often, sometimes, never</td>
</tr>
<tr>
<td></td>
<td>How do you feel about your job as a whole, taking everything into consideration?</td>
</tr>
<tr>
<td></td>
<td>Response options:</td>
</tr>
</tbody>
</table>

Taking into consideration the above limitations, the key issues identified from the literature, data from pilot testing and advice from the Steering Committee, a tool was developed that would suit the population and the aims of the study. The issues that were considered most critical to the study included:

- Job demands and work rates
- Job control and involvement with decisions at work
- Job satisfaction and meaning of work
- Social support, quality of leadership, and feedback from supervisors
- Social support from colleagues.
3.4 Work Environment & Worksite Equipment Survey Tools

A Work Environment Survey and a Worksite Equipment Survey were developed to assist in gathering data at the worksites. These assessment tools were based on The National Standard and National Code of Practice for Manual Handling (NOHSC 2002, the National Code of Practice for the Prevention of Occupational Overuse Syndrome (NOHSC 1994) and relevant literature.

The Work Environment Survey included an assessment of: cleaning rooms; access to sinks; layout and design of premises; description of typical rooms; furnishings and fixtures; furniture coverings; lighting; steps and stairs; ventilation; temperature; access to skip bins; outdoor areas; security issues; other relevant OHS issues; and main population/user groups at the premises.

The Equipment Survey included information on the type of equipment used for each task; description of equipment; size/capacity; height/length; weight; brand name; serial number; approximate age of equipment; condition of equipment; and comments from workers about the ease of use and effectiveness of the equipment.

The Cleaners' Survey as well as the Work Environment and Worksite Equipment Surveys were piloted tested by all three researchers with three cleaners at a tertiary institution. Modifications were then made to the questionnaires and surveys to enhance usability in the field and improve question design.

3.5 Physical Risk Assessment Tools

Various methods have been developed to track postures and measure postural loads in order to assess potential risk factors for MSDs in industry. The methods can be divided into:

1. direct measurements;
2. observational methods; and
3. self report techniques (Kilborn 1994; Li & Buckle 1999).

They require tools ranging from the expensive and highly technical equipment down to simple paper techniques.

After an extensive review of the literature, a number of risk assessment tools were identified and reviewed to determine the best available tool that met the criteria of the study. The tools reviewed included:

- Quick Exposure Check (Li & Buckle 1999)
- Revised NIOSH Equation (Waters et al 1993)
- RULA Rapid Upper Limb Assessment (McAtamney & Corlett 1993)
- REBA Rapid Entire Body Assessment (Hignett & McAtamney 2000)
- OCRA (Occhipinti 1998)
- The Strain Index (Moore & Garg 1995)
- A posture and load sampling approach to determining low back pain risk (Neumann et al 2001)
- An observation method to assess physical loads imposed on the upper extremities (Kebbel et al 2001)

Each of these tools was carefully assessed to determine their suitability for field use, for the tasks and the population. Many analysis tools were considered but then rejected for a number of reasons. For example, the Borg Scale (1982) was reviewed as it is used to measure perceived exertion and provide a subjective judgment about an activity and its effect on the body as a whole. However, during pilot testing it became apparent that it was not feasible to use the Borg Scale for data collection due to the noise from cleaning equipment (eg vacuum
cleaners), literacy levels, the need to continually interrupt the workers' workflow, and the disruption to the workers' concentration.

After preliminary pilot testing, two risk assessment tools were finally selected as being suitable to assess the risk factors for work-related upper limb MSDs in cleaning tasks. The tools were the Manual Tasks Risk Assessment Tool (ManTRA) version 2.0 (Burgess-Limerick et al 2004) and the Rapid Upper Limb Assessment Tool (RULA) (McAtamney & Corlett 1993). Both are observational methods for studying musculoskeletal load. Observational methods such as ManTRA and RULA offer a compromise between the high cost of direct methods (where devices are attached to the body) and the low validity and subjectivity of self-reported techniques (Kliom 1994). The methods selected are non-invasive, simple measurement approaches which were able to be applied without interference while workers performed their regular duties. These tools also require the researcher's judgment to identify the various body postures. Videotaping the workers while performing their normal duties also allowed a more detailed analysis to be conducted, thus reducing observation errors.

ManTRA was specifically selected, as it is able to measure the key risk factors highlighted for work-related MSDs, that is, repetition, force, posture, and vibration (Bernard 1997). ManTRA was developed as a tool to use in the field and was initially designed to be used by workplace health and safety inspectors in Queensland when assessing the ergonomics of work tasks. The physical risk component combines information about the total time for which a person performs the task in a typical day (exposure) and the typical time for which the task is performed without a break (duration) with an assessment for each of four body regions, of five characteristics of the task (cycle time, force, speed, awkwardness and vibration). The assessment of each characteristic is for the task as a whole, rather than individual task elements.

RULA is also an observational method that assesses the postures of the neck, trunk and upper limbs along with muscle function and the external loads experienced by the body (McAtamney & Corlett 1993). RULA evaluates ergonomic stress exposure by using body posture diagrams and scoring tables to specify posture zones. The posture limit guidelines and risk scores are based on the combined findings of several ergonomic studies (McAtamney & Corlett 1993). A coding system is used to generate a risk score which indicates the level of intervention required to reduce the risks of injury due to physical loading on the worker. As opposed to ManTRA, RULA scoring is performed at a discrete point in time, and selection is based either on the posture held for the greatest amount of the work cycle or where the highest loads occur.

### 3.6 Site Selection and Sample Size

The criteria for site selection nominated by the consultants included:

- Located in the Illawarra and Sydney Metropolitan regions;
- Site management's willingness to allow the researchers to conduct data collection on their site (eg School Principal, building owner, operations manager etc);
- Two or more people doing cleaning work employed at the site, to allow maximum efficiencies in data collection and minimum disruption to the workplace; and
- Cleaning workers with good verbal English skills.

Initial contact was made with 5 large cleaning businesses (ie more than 100 cleaning employees) and 15 commercial recreational and/or commercial residential businesses in NSW. Assistance with contacting these businesses and gaining agreement was obtained from the

<table>
<thead>
<tr>
<th>Location</th>
<th>No. of sites visited</th>
<th>No. of workers interviewed</th>
<th>No. of workers filmed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schools</td>
<td>11</td>
<td>35</td>
<td>23</td>
</tr>
<tr>
<td>Commercial Office</td>
<td>5</td>
<td>54</td>
<td>13</td>
</tr>
<tr>
<td>Commercial residential and/or</td>
<td>6</td>
<td>20</td>
<td>12</td>
</tr>
<tr>
<td>commercial recreational</td>
<td>Total</td>
<td>23</td>
<td>66</td>
</tr>
</tbody>
</table>

### 3.7 Data Collection

At each of the selected work sites, each worker was informed of the purpose of the study and verbal consent was obtained to interview them. Consent was also obtained from the workers to videotape them performing their usual duties. If consent was granted, the participants were interviewed using the Cleaners' Survey (see Appendix) to gather relevant information. If the workers gave permission to be videotaped they were asked to perform their normal work tasks for that shift. The tasks observed and filmed included:

- Wet mopping
- Static mopping
- Vacuuming
- Polishing/Buffing
- Detailing — damp wiping and dusting
- Emptying rubbish bins
- Cleaning toilets

Except for toilet cleaning, these tasks were selected by the Cleaning Steering Committee and are common cleaning tasks performed across all sectors that involve repetitive use of the...
upper limb. Toilet cleaning was added due to it being another of the most common tasks and due to the reported and apparent difficulty with this task.

Each worker was videotaped for the duration of the tasks, using a hand held Sony digital video camera, while they performed their normal cleaning duties and adhered to their normal methods of work. The filming angle was selected to give the best full and clear view of the subject’s whole body, unobstructed by furniture and equipment. Filming took place from the start of the task to completion of the task (eg, vacuuming a complete classroom or hotel room). Information was gathered from the worker regarding the tasks performed and the amount of time taken to perform these tasks. This information was used later in determining the duration and total time components for the ManTRA assessment. Because of the differences between the sites, some tasks regularly performed at one site may not have been observed at other sites. For example, cleaners in commercial office environments were rarely seen buffing floors during the time of the site visits.

Observations of the workplace and work practices were also conducted at each worksite using the Work Environment and Equipment Survey Tools. The survey tools were used by the researchers to collect information on work environment factors, types of equipment used and the workplace layout. Dimensions of equipment and fixtures were collected during this stage of the process where possible. Workplaces and tasks were generally observed over 3 to 4 hours under normal operating conditions.

There were a number of limitations with data collection at some sites. At a number of sites, observation and videotaping of the cleaning staff was not able to be performed for the full shift due to constraints such as security and access issues. This was particularly true for commercial office sites. Another issue during data collection that caused problems was that the occupiers of some of the commercial sites generally (i.e., office, residential and recreational) were very sensitive to the researchers’ presence—particularly regarding filming. It was therefore extremely difficult to obtain good video footage at these sites and videotaping that was able to be performed was quite limited.

Other issues that may have impacted on data collection, particularly during the interviews with workers, were that at some sites the cleaning supervisors needed to escort the researchers between areas due to security and access issues. This resulted in some cases where the supervisor was nearby when the worker was interviewed which may have affected the worker’s answers to some questions. Whilst every effort was made to minimize this problem it was not always possible. Another limiting factor that the researchers were extremely aware of and sensitive to, was time constraints for extended interviews and discussion, conscious that the workers still had their jobs to do. Poor literacy of some workers was another issue which meant that not all Cleaner Surveys were completed fully.

3.8 Measurement of Weight and Forces

A sample of weights, and pushing and pulling forces were measured using a Salter Model 16 tension and compression tester. Forces were also gathered from past, recent research (Paver et al 1997) and from equipment company’s technical specifications data.

3.9 Employer survey

Two surveys were developed for employers of cleaning workers. Companies were assured that the data would be pooled, with no identifiers used, and the results would remain confidential. Employers were asked to forward the surveys to those best able to complete them, and this was assumed to be a combination of OHS Managers, Return to Work Injury Management personnel and Human Resource personnel.

The first survey requested information on the demographics of the cleaning workers, including age, gender, ethnic backgrounds, estimated literacy levels (in reading and conversational skills), and training provided to cleaning workers and completed by existing cleaning workers.

The second survey was designed to explore the rationale and methods used to select cleaning equipment, including:
- criteria for selecting equipment
- method of assessment
- personnel involved in the assessment
- personnel involved in the purchase decision
- schedules for maintenance and replacement

This survey also asked semi-structured and open-ended questions about what the companies found were the best sort of equipment for the common cleaning tasks, and if they could recommend any specific techniques or work methods, and if they had advice about duration on tasks.

Surveys were distributed via email to 7 companies following initial phone contact to explain the surveys and their rationale and to personally seek the companies input. The sample included 4 large cleaning companies and 3 large employers in the commercial residential and recreational sectors.

3.10 Data Analysis

3.10.1 Physical Risk Assessment (ManTRA, RULA)

Data for the physical risk assessments was collected from 23 worksites and video footage was collected from 47 workers performing their normal work tasks during one shift. To analyse and quantify the musculoskeletal demands of the selected cleaning tasks, the manual task risk assessment tool (ManTRA) and the rapid upper limb assessment (RULA) tools were used. All the ManTRA and RULA analysis was carried out from the videotapes, by one trained researcher to avoid possible inter-observer variability.

ManTRA Analysis

ManTRA provides a risk rating for exposure to musculoskeletal risk factors for different body regions associated with manual tasks in the workplace. The video footage of each cleaning task was ranked using ManTRA together with details of each task gathered from interviews (ie total time, task duration).

The scores for cycle time and duration were combined to provide a repetition risk score. Force and speed were also combined to provide an exertion risk. Each body region was then scored and a cumulative risk score was allocated by adding together the scores for duration,
Final Report – Assessment of the Repetitive Manual Tasks of Cleaners

repetition, exertion, awkwardness and vibration. This cumulative risk score provides a range between 5 and 25. A high risk of cumulative injury is indicated by the presence of multiple risk factors for a particular body region by calculating the sum of the five risk factors (ie total time, repetition, exertion, awkwardness and vibration).

Rapid Upper Limb Assessment (RULA) Analysis

RULA is based on definitions for postures of the back, arms, legs, head and neck and the force used in the work. RULA combines body posture diagrams and scoring tables to calculate a risk score of between 1 and 7 which is based upon the estimated risk of injury due to musculoskeletal loading. The same tasks from the ManTRA analysis were analysed using RULA. Selection of the postures to analyse was based on an initial observation of the selected tasks during several work cycles. The postures held for the greatest amount of the work cycle were first identified and then the posture was analysed where it was thought the highest loads occurred.

Analysis of Repetitive Upper Limb Work

Video recordings were analysed and sampling was conducted at variable intervals. The cycle times for the upper limb movements of the shoulder, elbow and wrist were determined. Comparison with the work from Kilborn (1994) was also used to determine the risk of upper limb MSD for workers performing the common cleaning tasks.

3.10.2 Analysis of Work Environment and Equipment

Following the site visits, the data from the Environment and Equipment Surveys were analysed. To assist in identifying the differences between the sectors and potential problems areas for MSD risk, each of the common factors was compared using a matrix format.

To clarify and to check information regarding equipment observed on sites, contact was made with twelve cleaning equipment suppliers, and technical specifications were obtained. Visits were also made to showrooms to assess equipment more closely. These methods assisted in triangulating, or verifying the information obtained at the visits.

3.11 Statistical Analysis

Simple statistics were used to describe the cleaning population, pain and discomfort, work organisational factors and physical risk assessment. Kruskal Wallis tests and one way between groups Annova were conducted to investigate whether significant differences exist between the three cleaning sectors (ie government contract, commercial office, commercial recreational and commercial residential). Differences were considered statistically significant at the 0.05 level. All statistical procedures were conducted using SPSS Software (Version 11.0).

4. Results & Discussion

4.1 Injury data analysis

The analysis of the claims data for the cleaning industry illustrated that:

- Cleaners are at high risk of sustaining workplace injuries and diseases – with one of the highest rates as compared with other occupations, and double the frequency rate of the average of all occupations
- Cleaners have a high rate of injury/disease from body stressing as compared with other occupations – and more than double the frequency of the average of all occupations
- The most common mechanism of injury for cleaners is ‘body stressing’, accounting for 45% of all claims in the past 10 years of available WorkCover NSW data
- The most common body location for body stressing in cleaners in NSW is the back
- The next most common body locations for body stressing in cleaners in NSW are the shoulder/upper arm, wrist/hand and fingers, and the elbow and forearm
- The low injury and disease rates reported for the Property and Business Services Industry can be misleading, and the data can disguise the actual risk to people employed within the Cleaning Services group of this industry

(NOHSC 2003; NOHSC 2002; WorkCover 2004; WorkCover 2002b)

A complete copy of the report regarding MSDs in cleaning work and in the cleaning industry was provided to the Steering Committee as part of this project (Weigall, Simpsoon & Bell 2004).

The injury claims experience in government sector cleaners was higher than other cleaners in other areas as is reflected in the higher workers compensation insurance premium rates. The higher rates could be due to a number of quite different factors including:

- the work environments
- the cleaning equipment
- the result of their longer duration doing cleaning work
- their greater age, and
- other individual factors

Injury statistics must be always be viewed cautiously as they may not be a true indication of injury rates. For example workers who were interviewed in this study had in many cases not disclosed their MSDs. Also, given that non-unionized workers are less likely to report injuries (Morse et al 2003), higher reported injury rates in the government sector cleaners may merely reflect higher rates of union membership.

4.2 Demographic Data

4.2.1 Workers' age and number of years cleaning

The responses from interviews with 66 people doing cleaning work were analysed. Of this group 69.7% were female and 30.3% were male, with an average age of 48.7 ± 11.7 years and a median age of 49 years. The average number of years they had worked as either a cleaner or doing cleaning work was 10.7 ± 8.4 years, with a range from less than 1 year to 34 years.
The demographic data comparing the sectors are provided in Table 10. For simplicity, all of these people employed to do various cleaning tasks (school cleaners, room attendants etc) will be called 'workers' in this report.

Table 10 – Demographic data for workers doing cleaning tasks

<table>
<thead>
<tr>
<th></th>
<th>Government Contract</th>
<th>Commercial Office</th>
<th>Commercial Residential &amp; Recreational</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (Mean, SD)</td>
<td>53.5 (8.0)</td>
<td>37.7 (11.6)</td>
<td>43.2 (10.1)</td>
</tr>
<tr>
<td>Years worked as a cleaner (Mean, SD)</td>
<td>12.6 (7.2)</td>
<td>4.8 (7.7)</td>
<td>11.3 (6.6)</td>
</tr>
<tr>
<td>Height (m) (Mean, SD)</td>
<td>1.3 (0.8)</td>
<td>1.4 (0.9)</td>
<td>1.6 (0.8)</td>
</tr>
<tr>
<td>Weight (kg) (Mean, SD)</td>
<td>77.4 (13.4)</td>
<td>67.7 (13.9)</td>
<td>64.5 (11.2)</td>
</tr>
<tr>
<td>Body Mass Index (kg/m^2) (Mean, SD)</td>
<td>28.5 (5.1)</td>
<td>25.9 (0.2)</td>
<td>24.6 (2.4)</td>
</tr>
</tbody>
</table>

Demographic data from the three completed employer surveys were consistent with these findings with regards to the age and gender information, suggesting that our sample was representative of the sectors of interest.

Statistical analysis using a one way between groups ANOVA was conducted to compare the workers' ages and number of years doing cleaning work between the three sectors. The government cleaners' ages were significantly higher \( F(1,63)=36.65, p<0.001 \) than those working in the other sectors. No significant differences were found between the sectors for the number of years doing cleaning work \( F(1,62)=4.52, p=0.38 \).

The age data shows that the median age of the workers surveyed (49 years) is well above the median age of Australian Public Service Employees at 41 years (WERC 2003a). The average age of government contract cleaners is the highest across the sectors, at 53.5 years. These figures are a reflection of Australia's ageing workforce. The other important factor is that the participation of females in the workforce is increasing, but particularly in the 45-64 age group, almost doubling since the mid 1980s (ABS 2003). In contrast, male participation in the workforce has fallen. This trend of an ageing and feminised workforce is expected to continue (WERC 2003a).

4.2.2 Weight and height

The workers were asked to self report their height and weight so that their Body Mass Index (BMI) could be calculated (NHMRC 1997). While it is acknowledged that people are likely to inaccurately report their height and weight, this data provides an overview of the body size and proportion of the population of workers that were interviewed. Interestingly 38% of the workers interviewed would be classified as overweight, while 20% would be classified as obese according to the current guidelines (ASSO 2004). The average government cleaner was classified as 'overweight'.

The prevalence of people being overweight or obese is increasing (NHMRC 1997). Our findings are consistent with a study of Australian adults in 1989 – 2000 which found that 39% were overweight and 20.8% were obese (ASSO 2004).

4.2.3 Language spoken

The workers were also asked what language they mainly spoke at home. The proportion of workers who mainly spoke English at home to those who mainly spoke another language is shown in Figure 2 and the variety of languages spoken at home is summarised in Table 11. Almost 70% of workers mainly spoke a language other than English at home.

Table 11 – Reported languages spoken at home

<table>
<thead>
<tr>
<th>Language</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arabic</td>
<td>1</td>
<td>1.5</td>
</tr>
<tr>
<td>Bengali</td>
<td>5</td>
<td>7.5</td>
</tr>
<tr>
<td>Cantonese</td>
<td>1</td>
<td>1.5</td>
</tr>
<tr>
<td>Croatian</td>
<td>3</td>
<td>4.5</td>
</tr>
<tr>
<td>English</td>
<td>20</td>
<td>30.3</td>
</tr>
<tr>
<td>Greek</td>
<td>7</td>
<td>10.6</td>
</tr>
<tr>
<td>Hausa</td>
<td>1</td>
<td>1.5</td>
</tr>
<tr>
<td>Korean</td>
<td>1</td>
<td>1.5</td>
</tr>
<tr>
<td>Macedonian</td>
<td>6</td>
<td>9.1</td>
</tr>
<tr>
<td>Mandarin</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Mandarin</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Nepali</td>
<td>1</td>
<td>1.5</td>
</tr>
<tr>
<td>Norwegian</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Polynesian</td>
<td>1</td>
<td>1.5</td>
</tr>
<tr>
<td>Portuguese</td>
<td>1</td>
<td>1.5</td>
</tr>
<tr>
<td>Russian</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Spanish</td>
<td>8</td>
<td>12.1</td>
</tr>
<tr>
<td>Thai</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Vietnamese</td>
<td>4</td>
<td>6.5</td>
</tr>
<tr>
<td>Total</td>
<td>66</td>
<td>100</td>
</tr>
</tbody>
</table>

These language results suggest that the majority of these workers are from non-English speaking backgrounds (NESB). In 2001-02, 24.6% of the Australian workforce was born overseas, so the survey group represent a higher than average rate of coming from an NESB. The impact of being a migrant in Australia with a NESB is higher rates of unemployment. According to the Australian Bureau of Statistics (2003) 8.1% of migrants from NESB are unemployed as compared with only 5.5% of English speaking migrants.

4.2.4 Work Hours

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The respondents reported that the average number of hours worked in their main cleaning job was 5.9 ± 1.7 hours per day, and 30 hours per week. One commercial office worker reported working a total of 55 hours per week, including some 11 hour days. Of those surveyed, just over 50% worked the hours in "split" shifts, including most of the government cleaners, while none of the commercial recreational or commercial residential workers did.

Of the sample, 23% had at least one other paid job, and this was most typical for commercial office workers, with 50% having another job, as compared with 18% of government contract cleaners. Those with another job reported working an average of 26 hours per week in this other job, and this ranged from 8 hours per week to 45 hours per week, with the highest median number of hours worked by commercial office cleaners (40 hours per week). The most common "other job" was working as a cleaner (47% of all other jobs). Other occupations included room attendant, kitchen hand, waitess, bar worker, factory worker, storeman and child care worker. Each of these additional jobs is physical in nature and is also at the lower end of the pay scale (ABS 2002).

As well as paid work, many workers reported having unpaid childcare responsibilities, and many commercial office cleaners were full-time students during the day.

### 4.2.5 General Health

The workers were asked about their general health in the survey and the responses are summarised in Table 12.

<table>
<thead>
<tr>
<th>Cleaner Responses</th>
<th>Excellent</th>
<th>Very Good</th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency %</td>
<td>(13)</td>
<td>(10)</td>
<td>(28)</td>
<td>(5)</td>
<td>(0)</td>
</tr>
</tbody>
</table>

Comparison with ABS data for all-age groups (15 years to 65 years) - 16.0% 32.3% 30.0% 9.1% 1.9%

Table 12 - In general, how is your health? - Responses from workers

Statistical analysis using a Kruskal Wallis test showed no significant differences ($\chi^2 = 0.471, p = .72$) between the three sectors and self reported health status of Cleaners.

Comparison with all people in the general population shows that these cleaning workers report being relatively healthy, with none reporting poor health and only 5.3% reporting fair health. This result is expected as the general population includes very old people and those with disabilities and who are not in the workforce, and cleaning work is classified as physically demanding work (Occupational Information Network 2004). As with the general population, the majority of respondents report being in very good or excellent health (54.4% of workers surveyed in this study compared with 51.7% of all persons) (ABS 2003).

### 4.3 Pain and Discomfort

Workers were also asked about their musculoskeletal health, and a questionnaire was used to determine if they had past and/or current episodes of trouble (defined as an ache, pain or discomfort) in their neck, arm, hands, back, and legs. The questions asked if they had experienced trouble at any time in the past 12 months, and at any time in the past 7 days, and if this trouble had prevented them from doing their normal work at home or at work.

Of the workers interviewed:

- 83% reported experiencing pain or discomfort during the past 12 months
- 66% reported experiencing pain or discomfort in the past 7 days
- the highest 12-month prevalence rates for musculoskeletal pain and discomfort were in the lower back (48.5%), wrists/hands (40.9%), and shoulders (39.4%)
- the lower back (16.2%) was the highest ranked body part for preventing normal work in the last 12 months.

The occurrence of musculoskeletal complaints experienced by workers over the last 12 months is shown in Table 13.

<table>
<thead>
<tr>
<th>Body Part</th>
<th>Percentage with pain &amp; discomfort last 12 months</th>
<th>Percentage prevented doing normal work in last 12 months</th>
<th>Percentage with pain &amp; discomfort last 7 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neck</td>
<td>34.6%</td>
<td>10.6%</td>
<td>9.8%</td>
</tr>
<tr>
<td>Shoulders</td>
<td>38.4%</td>
<td>14.1%</td>
<td>13.6%</td>
</tr>
<tr>
<td>Elbows</td>
<td>35.0%</td>
<td>10.6%</td>
<td>10.0%</td>
</tr>
<tr>
<td>Waist/Abdo</td>
<td>40.0%</td>
<td>10.6%</td>
<td>10.6%</td>
</tr>
<tr>
<td>Upper back</td>
<td>21.2%</td>
<td>6.1%</td>
<td>9.1%</td>
</tr>
<tr>
<td>Lower back</td>
<td>68.5%</td>
<td>15.2%</td>
<td>21.2%</td>
</tr>
<tr>
<td>Hips/thighs</td>
<td>21.2%</td>
<td>3.0%</td>
<td>13.6%</td>
</tr>
<tr>
<td>Knees</td>
<td>31.6%</td>
<td>7.6%</td>
<td>16.2%</td>
</tr>
<tr>
<td>Ankles/Feet</td>
<td>22.8%</td>
<td>6.1%</td>
<td>13.6%</td>
</tr>
</tbody>
</table>

In discussions at the worksites, the following additional comments were made by workers regarding their pain:

- "I take tablets to cope with the pain" (Cleaner, Primary School)
- "I have constant pain" (Cleaner, Primary School)
- "If you have something to do you just press on... despite the pain." (Cleaner, Primary School)
Comparison of Musculoskeletal Symptoms with Other Cleaning Workers

A comparison of the prevalence of pain and discomfort in this study with the Robens Centre for Health Ergonomics (Woods et al. 1999) cleaning study provides some interesting similarities. This Robens Centre study surveyed 1214 cleaners using a questionnaire posted to cleaners working in a variety of settings, with most of the respondents working in hospitals and schools. It can be seen from Table 14 that higher levels of musculoskeletal pain and discomfort were reported in the upper back, knees and ankles in this study than in the Robens Centre study. Annual prevalence of pain and discomfort for all other body parts was similar between both groups.

Table 14 - Annual Prevalence of Musculoskeletal Symptoms among Cleaners

<table>
<thead>
<tr>
<th></th>
<th>This Study</th>
<th>Robens Study (1999)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neck</td>
<td>33%</td>
<td>12%</td>
</tr>
<tr>
<td>Shoulders</td>
<td>32%</td>
<td>36%</td>
</tr>
<tr>
<td>Elbows</td>
<td>20%</td>
<td>17%</td>
</tr>
<tr>
<td>Wrist/hand</td>
<td>41%</td>
<td>39%</td>
</tr>
<tr>
<td>Low back</td>
<td>21%</td>
<td>22%</td>
</tr>
<tr>
<td>Lower back</td>
<td>49%</td>
<td>46%</td>
</tr>
<tr>
<td>Hip</td>
<td>32%</td>
<td>24%</td>
</tr>
<tr>
<td>Knee</td>
<td>26%</td>
<td>20%</td>
</tr>
<tr>
<td>Ankle</td>
<td>29%</td>
<td>18%</td>
</tr>
</tbody>
</table>

4.4 Work Organisation

The third part of the Cleaners' Survey addressed issues of work organisation. The workers were asked to rate their responses on a 3 point scale (often, sometimes, never) or a 5 point scale (very happy to very unhappy) to questions concerning job demand and work rates, job control and influence, job satisfaction and job meaning, support at work, leadership and feedback.

4.4.1 Job Demands and Work Rates

The workers were asked about how hard they had to work, if they had enough time to complete their work, and if they were able to get assistance from others if under pressure. The responses to these questions are shown in Figure 3.

The responses from the workers indicated that:
- 53% of the workers often had to work very fast
- 40.9% reported having to work very fast
- 54% reported only sometimes having enough time to complete their work
- 50% reported never being able to get help from others if under pressure to get their work done.

The responses from the interviews across the 3 sectors varied. Workers at government sites were often alone on the site or with just one other worker, so if the tasks were too demanding the ability to call on others for help was not always possible. At commercial office sites workers were generally on separate floors and not easy to contact or locate. On the contrary, room attendants in the larger hotels reported having systems for phoning the manager if they fell behind schedule (eg because of a particularly dirty room or a series of slow/late check outs) and there was more flexibility in the scheduling.

Demands within sectors also varied. For example at some schools one cleaner was responsible for cleaning all the toilets, and this was reportedly due to the fixed extra payment received for this task (if two cleaners shared the toilet cleaning each would have to receive the full extra payment). This resulted in situations where one cleaner may clean in excess of 50 toilets in one shift. In the commercial office and commercial recreational sites visited it was a common work practice for one or two cleaners to be allocated to cleaning toilets. In several sites cleaners were responsible for cleaning more than 100 toilets per shift. This resulted in little or no opportunity to change work tasks.

Comments from workers regarding work rates included:
- "Too much job" explaining about having to work quickly (Cleaner, High School)
- "I start early to get the work done" Cleaner reporting starting early each day (Cleaner, High School)
- "There's no time for breaks - supposed to have 10 minutes" (Cleaner, High School)
- "I have a lot of work to do" (Cleaner, High School)
- "I feel frustrated when there's not enough time." (Cleaner, High School)

Comparison of Job Demands and Job Control with Other Workers

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The cleaning study conducted by the Robens Centre (Woods et al. 1999) asked the same questions as this study in relation to job demands and work rates. As can be seen from Figures 3 and 4, more cleaners in this study reported having to work very fast compared to the Robens study (53% compared with 46%). Additionally, more cleaners in this study reported never being able to obtain help if they did not have enough time compared to the cleaners in the Robens study (50% compared with 35%). Interestingly in both studies approximately 50% of cleaners reported only sometimes having enough time to do everything and 20–25% reported never having enough time.

**Most difficult tasks**

In response to the question "What are the most difficult tasks for you, and why?" there was a spread of responses within and between the sectors. The only common point between the sectors was comments regarding the time being limited and that this factor affected all tasks. Specific tasks identified as being "difficult" by workers is summarised in Table 15.

<table>
<thead>
<tr>
<th>Task</th>
<th>Government sector</th>
<th>Commercial office sector</th>
<th>Commercial residential &amp; recreational</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scrubbing tables and desks</td>
<td>as marks hard to remove</td>
<td>as marks hard to remove</td>
<td>as marks hard to remove</td>
</tr>
<tr>
<td>Cleaning hard floors - large areas to clean</td>
<td>particularly hard in wet periods with tracked mud</td>
<td>particularly hard in wet periods with tracked mud</td>
<td>particularly hard in wet periods with tracked mud</td>
</tr>
<tr>
<td>Doing the 'big clean up'</td>
<td>- as heavy and repetitive</td>
<td>- as heavy and repetitive</td>
<td>- as heavy and repetitive</td>
</tr>
<tr>
<td>Cleaning out 150 bins per day</td>
<td>- as heavy and repetitive</td>
<td>- as heavy and repetitive</td>
<td>- as heavy and repetitive</td>
</tr>
<tr>
<td>Using the blow vac</td>
<td>- as heavy and repetitive</td>
<td>- as heavy and repetitive</td>
<td>- as heavy and repetitive</td>
</tr>
<tr>
<td>Sweeping</td>
<td>- as heavy and repetitive</td>
<td>- as heavy and repetitive</td>
<td>- as heavy and repetitive</td>
</tr>
<tr>
<td>Maintaining the outdoor area</td>
<td>- as large area and leaves make it look messy</td>
<td>- as large area and leaves make it look messy</td>
<td>- as large area and leaves make it look messy</td>
</tr>
<tr>
<td>Nothing</td>
<td>- 7 responses</td>
<td>- 3 responses</td>
<td>- 1 response</td>
</tr>
</tbody>
</table>

4.4.2 Job Control and Influence

As illustrated in Figure 5, of the workers interviewed, 49% felt they had some influence over ‘how’ they did their work and to some extent when they were able to take rest breaks. While 57% of the cleaners interviewed indicated that they never have any influence over the amount of work they were expected to complete, 58% also reported never having any influence of ‘what’ they did.
generally reported not having been involved in the area allocation, and some felt the allocation was unfair with some site areas having greater cleaning requirements than others. In other cases the cleaners felt that the total workload could not be safely managed with the number of staff and the number of hours allocated. Consultation between the cleaners and management regarding the areas to be cleaned and the time allocated appeared to be limited.

Where workers had some control over their work and the work order, they were generally happier and managed better, as illustrated by this comment:

"After injury, I change system. Now I mop, then vacuum, then mop. Easier for me." (Cleaner, High School)

Equipment

In most cases the workers were supplied with a limited range of equipment (see also Section 4.6). The study identified that workers most likely to have anything other than 'standard equipment' were those who had returned to work following injury and had been supplied with alternative, often lighter or long handled equipment.

In the cases where workers had been involved with equipment selection they reported being satisfied with the equipment as it was often more comfortable and usable than other equipment, so helped them to work more efficiently and safely.

Comparison of job control and influence with other cleaners

The main areas of difference between this study and the Robens Centre study are the workers in this study reported having less influence over 'what' that did but having more control over when they were able to take breaks than cleaners in the Robens Centre study. A comparison of this study with the Robens Centre Study is summarised in Table 16.

Table 16 - Comparison with Robens Centre Study (1999)

<table>
<thead>
<tr>
<th>Work Organisation Factors</th>
<th>Often</th>
<th>Sometimes</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>Have a choice in deciding how you work?</td>
<td>55%</td>
<td>31%</td>
<td>14%</td>
</tr>
<tr>
<td>Have a choice in what you do?</td>
<td>39%</td>
<td>27%</td>
<td>34%</td>
</tr>
<tr>
<td>Decide when you break?</td>
<td>15%</td>
<td>28%</td>
<td>55%</td>
</tr>
</tbody>
</table>

4.4.3 Job satisfaction and job meaning

Cleaners were also asked if they felt that the work they did was important. No significant differences ($\chi^2 = 4.18, p = .12$) were found between the three sectors. Figure 6 shows the responses of workers in each sector.

Figure 6 – Importance of job

However from the interviews with the workers, there appeared to be two distinct groups. There were those who identified strongly as being a ‘cleaner’ or a room attendant and believed the job was both very important and potentially very satisfying, and those who did cleaning as a temporary job or a second occupation and did not have strong feelings for the job. A comparison of the two groups of workers is evident from these quotes:

"'I love it! It's in my blood!" (High School Cleaner – long term worker)

"I'm not a cleaner. My family are not cleaners. Work is for survival..." (Commercial office cleaner – new)

The first group of workers were reported taking great pride in their work and appeared determined to achieve a high standard for their areas. This group often reported doing extra tasks or doing the cleaning more thoroughly than was required as they wanted to achieve a clean work area and feel greater satisfaction. The second and much smaller group of workers was more likely to view their job as a 'means to an end' in terms of income and felt less attachment to their job, and often saw the job as temporary until they could gain alternate employment.

Other comments by workers illustrated their feelings about their role, and their desire to do a thorough job:

- "I like to be as clean as my home." (Cleaner, High School)
- "I can’t walk past something dirty" (Cleaner, Primary School)
- "I like to do a good job" (Cleaner, High School)
A high percentage (60%) of workers reported that they were happy with their job as a whole. No statistically significant differences were found between the three sectors.

However one issue of particular concern to government and commercial office cleaners was job security. Workers explained that their employment was often affected by their employer’s successful tendering for new contracts. If workers were forced to move between employers they risked losing various employment service entitlements.

4.4.4 Support at work, leadership and feedback

The workers were also asked how they felt about the help and support they received from supervisors and work mates, and the recognition/feedback they received from their supervisor and from others at the workplace (eg teachers, office workers etc).

The workers completed a 5 point diagrammatic/verbal rating scale that indicated if they were very happy to very unhappy for these factors. The first two categories (very happy, happy) and the last three categories (OK, unhappy, very unhappy) were combined to produce the following results, summarised in Figures 8 and 9.

No significant differences were found between the sectors for questions relating to the help and support the cleaners received from their work mates ($\chi^2 = 1.36, P = .51$); the recognition/feedback they received from their supervisor ($\chi^2 = 2.56, p = .28$); and from others at the workplace they clean ($\chi^2 = 1.66, p = .43$). However, a significant difference was found between the sectors in response to the question relating to the support the cleaners received from their supervisors ($\chi^2 = 7.86, p = .02$). When compared to the other two sectors, government contract cleaners were found to be significantly more unhappy about the support they received from supervisors. Many reported to be very frustrated and even angry with the supervisors.

From discussions with all workers, but in particular government cleaners, it was evident that most believed their supervisors were “nice people”, however they felt the supervisor was unable to provide them with the support they required. Examples workers provided were:

- Supervisors that did not fix or replace faulty equipment within a reasonable time frame or failed to take action despite numerous requests; and
- Supervisors that did not appear to take their OHS concerns seriously, eg regarding site safety, work rates, storage, equipment selection etc

Possible reasons for this reported lack of supervisory support suggested by government cleaners were that the supervisor:

- had too many sites to look after (eg 180 separate sites) so was too busy to do a proper job
- lacked skills in people management and communication
- lacked skills in budget management
- had an inadequate budget to work from, so could not replace worn or faulty equipment as required (eg supply new mop-heads)

Other comments made by workers included:

- “Supervisor is friendly, but doesn’t provide equipment” (Cleaner, High School)
- “My work is not appreciated” (Cleaner, Primary School)
- “I would like a faster response!” (Cleaner, Primary School)
- “We don’t see him much...” referring to the supervisor (Cleaner, Primary School)
- “We have no support!” (Cleaner, High School)
4.6 Physical Risk Assessment

4.6.1 ManTRA

One of the aims of ManTRA is to enable an assessment of the exposure to musculoskeletal risk factors associated with manual tasks in the workplace.

Repetition risk is determined by assessing cycle time and task duration, then a combined score for repetition is allocated (max score = 5). Exertion risk is determined by assessing force and speed, and these codes are combined to give an overall score for exertion (max score = 5). The cumulative risk score is calculated by adding together the codes for total time, repetition risk, exertion risk, awkwardness and vibration.

According to Burgess-Limerick et al 2004:

"Action may be indicated if, for any body region if the Exertion Risk factor is 5, the sum of Exertion or Awkwardness is 8 or greater, or the Cumulative Risk score is 15 or greater. A maximum score for exertion for any body region, or a combined exertion and awkwardness score, indicates a high risk of acute injury; while a high risk of cumulative injury is indicated by the presence of multiple risk factors for any particular body region".

As can be seen in Table 17 and 18 the upper limb and neck/shoulder regions consistently scored higher than the back or lower limb for the Cumulative Risk scores and Exertion/Awkwardness scores emphasizing that the upper limb is at risk of developing a MSD.

<table>
<thead>
<tr>
<th>Task</th>
<th>Lower Limb</th>
<th>Back</th>
<th>Neck/Shoulder</th>
<th>Hand/Arm/Wrist</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wet Mopping</td>
<td>7.7</td>
<td>8.5</td>
<td>12.0</td>
<td>12.4</td>
</tr>
<tr>
<td>Static Mopping</td>
<td>7.5</td>
<td>8.4</td>
<td>10.5</td>
<td>11.9</td>
</tr>
<tr>
<td>Vacuuming</td>
<td>8.8</td>
<td>10.7</td>
<td>13.6</td>
<td>14.1</td>
</tr>
<tr>
<td>Buffing</td>
<td>8.0</td>
<td>10.1</td>
<td>12.0</td>
<td>12.3</td>
</tr>
<tr>
<td>Detailing</td>
<td>7.8</td>
<td>9.5</td>
<td>11.1</td>
<td>11.2</td>
</tr>
<tr>
<td>Cleaning Toilets</td>
<td>8.1</td>
<td>10.4</td>
<td>11.8</td>
<td>11.9</td>
</tr>
<tr>
<td>Emptying Rubbish</td>
<td>8.2</td>
<td>10.5</td>
<td>12.0</td>
<td>12.8</td>
</tr>
</tbody>
</table>

Table 17 – Average Cumulative Risk scores for common tasks performed by cleaners

<table>
<thead>
<tr>
<th>Repetition Risk</th>
<th>Exertion Risk</th>
<th>Exertion + Awkwardness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower Limb (LL)</td>
<td>B</td>
<td>NS</td>
</tr>
<tr>
<td>Wet Mopping</td>
<td>3.1</td>
<td>5.1</td>
</tr>
<tr>
<td>Static Mopping</td>
<td>3.3</td>
<td>3.3</td>
</tr>
<tr>
<td>Vacuuming</td>
<td>3.9</td>
<td>3.9</td>
</tr>
<tr>
<td>Buffing</td>
<td>3.6</td>
<td>3.6</td>
</tr>
<tr>
<td>Cleaning Toilets</td>
<td>3.3</td>
<td>3.3</td>
</tr>
<tr>
<td>Emptying Rubbish</td>
<td>3.7</td>
<td>3.7</td>
</tr>
</tbody>
</table>

Table 18 – Average Repetitive Risk, Exertion Risk and summed Exertion and Awkwardness scores for common tasks performed by cleaners

The average cumulative risk scores were below 15 for all body areas, with scores ranging from 6 to 18 for all body regions. While on average the scores for each body part are below 15, this may be due to most cleaners working either total daily shifts of 3 to 4 hours or split shifts of 3 to 4 hours each. When calculating the cumulative risk score in this study, the total time was calculated as time per shift. However if the cumulative risk score was to be calculated per day, the scores on average would be likely to be several points higher as the government contract cleaners tend to work split shifts. The total risk scores for government cleaners and others working 6 – 7 hours per day would be approximately 1 to 2 points higher, bringing a number of tasks for the upper limb and neck/shoulder body regions into this higher risk level. The impact of other jobs (ie second jobs held by these workers) would further increase the risk scores if the job had similar physical demands.

This study identified that the highest cumulative risk scores were for the upper limb and neck/shoulder body regions for vacuuming tasks. These higher scores may be attributable to the number of workers who worked 8 hour shifts or who were required to perform vacuuming tasks for the majority of their shift with little opportunity to change tasks. Another factor which may have resulted in these higher scores was the mismatch of the vacuum type with the work environment or the wand length with the height of the worker. The use of poorly suited equipment can result in workers adopting awkward postures that increase injury risk, such as bent and twisted back postures, and working with the shoulders elevated and reaching across the body.

The average scores for Repetition Risk are below the maximum score of 5, and this is due to the workers frequently changing their tasks. In this case even though cycle time was scored as 'high', the task duration impacted on lowering the Repetition Risk score. This further highlights that considering repetition in isolation does not properly explain the risks in the tasks. All factors need to be considered.

Statistical analysis using a Kruskal Wallis test was also conducted to compare the cumulative risk scores for each body area for each task between the three sectors. No significant differences were found between the sectors for vacuuming, buffing and emptying rubbish bins for all body area cumulative risk scores. Significant differences between the sectors were found for wet mopping in the neck/shoulder ($\chi^2 = 5.96$, $p = .05$) and arm/shoulder ($\chi^2 = 9.2$, $p = .01$) body areas.

The government contractors had significantly lower cumulative risk scores than the other two sectors. This may be attributed to the government cleaners being more experienced cleaners who may have better techniques. Paver et al (1997) in their study on wet mopping found that cleaners with limited experience of mopping demonstrated less desirable postures (eg forward bending and twisting of the back) than more experienced cleaners. Another reason for the higher scores in the commercial office and commercial residential/leisure sectors was that these cleaners often had to wet mop in more confined spaces such as toilets and bathrooms, which would lead to cleaners having to adopt awkward postures. Wet mopping in more open spaces such as class rooms may allow these cleaners to adopt safer postures.

Although ManTRA was useful for determining the risk of MSD for specific cleaning tasks it was not sensitive enough to specifically identify risks associated with shoulder, hand and wrist postures. Therefore, further analysis using the Rapid Upper Limb Assessment tool was undertaken to complement the ManTRA analysis.

4.6.2 Rapid Upper Limb Assessment (RULA)

The average cumulative risk scores were below 15 for all body areas, with scores ranging from 6 to 18 for all body regions. While on average the scores for each body part are below 15, this may be due to most cleaners working either total daily shifts of 3 to 4 hours or split shifts of 3 to 4 hours each. When calculating the cumulative risk score in this study, the total time was calculated as time per shift. However if the cumulative risk score was to be calculated per day, the scores on average would be likely to be several points higher as the government contract cleaners tend to work split shifts. The total risk scores for government cleaners and others working 6 – 7 hours per day would be approximately 1 to 2 points higher, bringing a number of tasks for the upper limb and neck/shoulder body regions into this higher risk level. The impact of other jobs (ie second jobs held by these workers) would further increase the risk scores if the job had similar physical demands.

This study identified that the highest cumulative risk scores were for the upper limb and neck/shoulder body regions for vacuuming tasks. These higher scores may be attributable to the number of workers who worked 8 hour shifts or who were required to perform vacuuming tasks for the majority of their shift with little opportunity to change tasks. Another factor which may have resulted in these higher scores was the mismatch of the vacuum type with the work environment or the wand length with the height of the worker. The use of poorly suited equipment can result in workers adopting awkward postures that increase injury risk, such as bent and twisted back postures, and working with the shoulders elevated and reaching across the body.

The average scores for Repetition Risk are below the maximum score of 5, and this is due to the workers frequently changing their tasks. In this case even though cycle time was scored as 'high', the task duration impacted on lowering the Repetition Risk score. This further highlights that considering repetition in isolation does not properly explain the risks in the tasks. All factors need to be considered.

Statistical analysis using a Kruskal Wallis test was also conducted to compare the cumulative risk scores for each body area for each task between the three sectors. No significant differences were found between the sectors for vacuuming, buffing and emptying rubbish bins for all body area cumulative risk scores. Significant differences between the sectors were found for wet mopping in the neck/shoulder ($\chi^2 = 5.96$, $p = .05$) and arm/shoulder ($\chi^2 = 9.2$, $p = .01$) body areas.

The government contractors had significantly lower cumulative risk scores than the other two sectors. This may be attributed to the government cleaners being more experienced cleaners who may have better techniques. Paver et al (1997) in their study on wet mopping found that cleaners with limited experience of mopping demonstrated less desirable postures (eg forward bending and twisting of the back) than more experienced cleaners. Another reason for the higher scores in the commercial office and commercial residential/leisure sectors was that these cleaners often had to wet mop in more confined spaces such as toilets and bathrooms, which would lead to cleaners having to adopt awkward postures. Wet mopping in more open spaces such as class rooms may allow these cleaners to adopt safer postures.

Although ManTRA was useful for determining the risk of MSD for specific cleaning tasks it was not sensitive enough to specifically identify risks associated with shoulder, hand and wrist postures. Therefore, further analysis using the Rapid Upper Limb Assessment tool was undertaken to complement the ManTRA analysis.

4.6.2 Rapid Upper Limb Assessment (RULA)

The average cumulative risk scores were below 15 for all body areas, with scores ranging from 6 to 18 for all body regions. While on average the scores for each body part are below 15, this may be due to most cleaners working either total daily shifts of 3 to 4 hours or split shifts of 3 to 4 hours each. When calculating the cumulative risk score in this study, the total time was calculated as time per shift. However if the cumulative risk score was to be calculated per day, the scores on average would be likely to be several points higher as the government contract cleaners tend to work split shifts. The total risk scores for government cleaners and others working 6 – 7 hours per day would be approximately 1 to 2 points higher, bringing a number of tasks for the upper limb and neck/shoulder body regions into this higher risk level. The impact of other jobs (ie second jobs held by these workers) would further increase the risk scores if the job had similar physical demands.
Analysis of the workers’ upper limb postures and movements was undertaken using the Rapid Upper Limb Assessment (RULA). RULA uses body posture diagrams for the upper arm, lower arm, wrist, neck, trunk and legs. The postures of the worker are coded according to the amount of flexion/extension, abduction/adduction away from the midline, and twisting. Scores are also allocated for repetition or static loading and the forced flexed elbow. These body posture diagram codes and scoring tables are combined to calculate a risk score of between 1 and 7. A risk score of 5 or 6 indicates that investigation and changes are required soon. A score of 7 indicates that investigation and changes are required immediately (McAtamney & Corlett 1993).

The average risk scores for the common cleaning tasks performed by the cleaners are shown in Table 19.

<table>
<thead>
<tr>
<th>Task</th>
<th>Number</th>
<th>Mean Risk Score</th>
<th>SD</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vacuuming</td>
<td>33</td>
<td>5.6</td>
<td>1.2</td>
<td>3-7</td>
</tr>
<tr>
<td>Wet Mopping</td>
<td>20</td>
<td>7.6</td>
<td>0.7</td>
<td>7-9</td>
</tr>
<tr>
<td>Static Mopping</td>
<td>7</td>
<td>6.6</td>
<td>1.5</td>
<td>3-7</td>
</tr>
<tr>
<td>Deterging</td>
<td>18</td>
<td>6.2</td>
<td>0.9</td>
<td>4-7</td>
</tr>
<tr>
<td>Cleaning Toilets</td>
<td>7</td>
<td>6.6</td>
<td>0.5</td>
<td>6-7</td>
</tr>
<tr>
<td>Empting Rubbish</td>
<td>5</td>
<td>5.2</td>
<td>1.9</td>
<td>3-7</td>
</tr>
<tr>
<td>Buffing</td>
<td>7</td>
<td>6.1</td>
<td>0.4</td>
<td>6-7</td>
</tr>
</tbody>
</table>

Note: the maximum score that can be achieved in the RULA analysis is 7.

The RULA scores for all tasks are high and the task of wet mopping consistently exceeded acceptable limits and changes are required immediately to reduce excessive loading of the musculoskeletal system and the risk of injury. All the other tasks risk scores were between 5 and 6, and this signifies that changes are also required. Statistical analysis using a Kruskal-Wallis test was also conducted to compare the risk scores for each task between the three sectors. No significant differences were found between the sectors for any of the tasks.

4.5.3 Repetitive Work of the Upper Limb

While there is no specific definition of ‘repetitive’ in the ergonomics literature, Kilborn (1994) provides some guidance for repetition of the upper limb that may increase risk. The features of ‘high risk’ tasks are described in Table 20.

Table 20 - Rate of work causing high risks for musculoskeletal disorders (Kilborn 1994)

<table>
<thead>
<tr>
<th>Body area</th>
<th>Frequency of movement contraction per minute (static or static)</th>
<th>Risk modification - very high risk if modified by:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shoulder</td>
<td>More than 2.5</td>
<td>High external force, spread, high static load, extreme posture, lack of training, high demands on output, movement, lack of control, high duration of repetition</td>
</tr>
<tr>
<td>Upper arm/lower arm</td>
<td>More than 10</td>
<td></td>
</tr>
<tr>
<td>Forearm/wrist</td>
<td>More than 10</td>
<td></td>
</tr>
</tbody>
</table>

The findings from the ManTRA analysis identified that most cleaners assessed demonstrated cycle times in the upper limb of less than 10 seconds in duration. Combining these cycle findings calculated from the ManTRA analysis and the above definition, all of the common cleaning tasks analysed in this study would be considered to be ‘repetitive’ for the shoulder, upper arm/lower arm and forearm/wrist. However, the Repetition Risk calculated using ManTRA (see Table 18) showed scores that were below the maximum score of 5, and this was due to the Repetition Risk being a combination of task duration and cycle time. In most cases cleaners frequently changed tasks, resulting in the duration of each task being minimised.

These tasks are also considered to be ‘high risk’ due to the repetitive nature of the work, the awkward upper limb postures, and the speed required. Jobs that require constant motion without adequate breaks do not provide for muscle recovery, and so place muscles at risk of fatigue and strain. Repetitive tasks that also require significant force, awkward postures or static postures further increase the risk of musculoskeletal injury (OSHA 1998; NOHSC 1994).

4.6 Equipment Survey Results

Across the 3 sectors of interest there was a range of manual and other equipment provided for cleaning tasks. The main findings with the equipment are described below and the typical equipment seen at the site visits is summarised in Table 21.

4.6.1 Wet mopping equipment

Most cleaners were supplied with mops on aluminium shafts and with plastic ferrules, though timber handles are still observed at some work sites. Of a small sample of cleaners at various sites, all reported the aluminium handles to be easy to use, not slippery to grasp, and lighter than the timber handles. The most notable issue with the mops was their very long handle length, and in a number of cases these were seen to be well above the head height of the user. Earlier research identified that handles should be approximately level with users’ chin height as longer handles require excessive shoulder flexion and abduction and increase the risk of shoulder injury (WorkCover 1998). These poor and potentially damaging shoulder postures were evident in many of the workers observed in the survey. Mop handles are available in a range of lengths (1350mm, 1500mm & 1800mm) and can also be cut down to suit workers, but handle length was generally not selected or adapted to suit the workers surveyed.

In nearly all cases observed, the buckets used were plastic wringer buckets (15 or 16 litres) with wide mouths and either a plastic or metal wringer. The main differences were the foot plates for both anchoring the bucket and for applying pressure on the wringer mechanism. Some staff complained of foot pads being too small, sloped or slippery, and allowing their foot to slip off. On one model the bucket handle and wringer mechanism tended to strike the user on the shin when the mop was being rung out.

Mop heads observed in use were cotton or poly-cotton, with most cleaners appearing to prefer the lighter poly-cotton or spaghetti heads (with thinner strings), as these reportedly left less fluff and threads on the floor. Mop head size was not always evident, but sizes referred to as 24”-26” sized heads (500 – 650mm) appeared most common. Some cleaners believed the cotton was best for wet-mopping, while the poly-cotton was best for applying floor sealer.
At several sites in the commercial recreation and commercial residential sectors workers were observed to work on their hands and knees to clean the floors in hotel/motel bathrooms and around the toilets in other hospitality sites.

4.6.2 Vacuums

Vacuums varied across sectors, as outlined in Table 21. In schools, the vacuums were generally the oldest across the sectors and in the worst state of repair, however this was not the case at all sites visited. In some premises vacuums were estimated to be at least 12-15 years old (according to the cleaners and confirmed by equipment suppliers). The older backpack vacuums were the heaviest, being approximately 6kg when empty, as compared with the newer models (averaging 4.5kg for ten newer models).

Capacity for typical new backpack vacuums is 4-6 litres. Backpacks were generally held in frames made of either metal or plastic, and some had a triangular shaped plastic in a flexible moulding instead of a rigid frame. Shoulder harness and waist/hip strap design varied, with the easiest of these to fit and adjust having wide straps with Velcro fastenings. However, it was observed that the larger workers could not fasten the standard waist straps due to their wider girth size.

For vacuuming in rooms with a lot of furniture or many fixtures, most but not all workers found a backpack vacuum more convenient stating the canister type became caught on furniture. However others preferred the small canisters as they had no load on their back and the small units were easy to pull. These were also preferred when vacuuming was only of short duration, such as for room attendants in commercial accommodation.

At one of the premises a hip-mounted vacuum was used. The worker reported this was very comfortable and was preferred for her after shoulder and back problems. The worker did however note one disadvantage associated with the small capacity of the vacuum (only 2.2 litres), as it required more frequent emptying. All commercial residential and some school sites studied, used small industrial cleaners that were light (5-8kg) and had larger container capacity than the backpack vacuums (10-18 litre capacity for the canisters).

Floor nozzles and accessories varied, and the workers reported that the easiest nozzle to use was one with wheels on the nozzle, allowing easy pushing even with high suction. Some premises supplied these heads to cleaners on ‘light duties’ following back or arm injuries, but did not routinely supply them reporting the wheels were often not robust and tended to break. Floor tools were generally 270mm - 280mm wide (ie width of tool on the floor). Larger upright commercial vacuums cleaned a width of 380 to 640mm.

No adjustable wands were observed during the site visits, therefore there was no opportunity for the cleaners to adjust the length of the wand to suit their height. A number of cleaners were observed using very long wands for their height (often at chin height) was observed that the larger workers could not fasten the standard waist straps due to their wider girth size.

For vacuuming in rooms with a lot of furniture or many fixtures, most but not all workers found a backpack vacuum more convenient stating the canister type became caught on furniture. However others preferred the small canisters as they had no load on their back and the small units were easy to pull. These were also preferred when vacuuming was only of short duration, such as for room attendants in commercial accommodation.

4.6.3 Floor polishers

One brand of floor polisher was evident across most sites. This brand has machines with ‘straight line’ or ‘swing’ style operations. The weight of the polishers ranges from 29kg to 42kg, and this weight is an issue if polishers are pulled up and down steps or stairs – an activity which was observed at a few school sites. Cleaners also reported having to pull polishers up stairs in demountable buildings and in other buildings with different levels within the building.

Applying sealant and polish was generally with a mop, though many cleaners who had used the applicator preferred this as it was lighter and also provided faster coverage due to the width of the head (670mm wide) being 3 times as wide as the mop head at 230mm. While some cleaners preferred the straight line style over the swing, others reported that it was more tiring.

4.6.4 Emptying waste

Many cleaners commented that heavy items were often hidden within other waste, making the weight of the load very variable. This was a common problem at schools where industrial art created heavy waste. There was also “pressure” reported to save the plastic bin liner and instead to lift and tip the contents of the bin. For the heavy metal bins, weighing more than 3kg when empty, this was reported by cleaners as one of the more difficult tasks.

4.6.5 Cleaning and other trolleys

The typical trolley used in office blocks was the blue paper waste trolley. The reported and evident problems with this trolley for taller users was the low pushing height (780mm) requiring some workers to have to stoop, but also the fixed height that cleaners had to tip the waste over. For smaller cleaners the height of 780mm required lifting their arms above shoulder height to clear the bin over the side of the trolley. However as all wheels rotated this was easy to push from any side. When used outdoors (eg across courtyards) some cleaners complained about the wheels, saying larger wheels would make the trolley more stable and easier to push. Another, but less seen trolley was the Rubbermaid cleaners trolley. This trolley had a higher pushing side, dedicated space from which to suspend bags and capacity for carrying cleaning equipment such as buckets, various floor tools and detailing equipment.

4.6.6 Damp wiping / detailing equipment

Most cleaners were provided with standard cotton cloths and trigger action bottles to do wiping and detailing, but others were supplied with the newer microfibre products. Microfibre cloths are made of minute synthetic fibres that are split in order to trap dirt, dust and moisture from surfaces. According to an assessment by the Australian Consumers’ Association (2003), microfibre cloths were superior to standard cloths for picking up dust and dirt and polishing surfaces without leaving streaks and dust, and have the advantage of not requiring chemicals. From a physical and musculoskeletal view point, the main advantages appear to be the reduced rate of wringing out needed, and a smaller amount of pressure applied to surfaces to achieve the same or superior finish. However the microfibre cloths were not suited for cleaning up “heavy-duty grease and grime, baked on stains or soap scum” without the addition of a chemical cleaning solution (Australian Consumers’ Association 2003).

Another cleaning tool using microfibre fabric was long-handled tools with narrow strips of the cloth bound at one end. These were used for high dusting or dusting bookshelves etc. There are also commercially available microfibre mops for floor cleaning, and these claim to be lighter, require less water, and be twice as fast as cleaning hard floors with the conventional mop and bucket method (Microfibre Cleaning Technology 2004).
To reach low tables (such as in primary schools and kindergartens) some cleaners were supplied with long-handled tools – often a mop head on a cut-down timber handle. Other commercially available tools observed were long-handled dusters with cotton fringes (900mm handle with fringe).

Many workers reported that their chemicals and cleaning aids were inadequate, particularly for cleaning stained and marked surfaces such as school desks. Some cleaners in the government sector brought in their own chemical aids and brushes including various commercially available ‘erasers’ and ‘power pads’ that are small blocks gripped in the fingers for removing ink, crayon, built up grime, scuff marks etc. One worker used a floor cleaning product (a chemical stripper) for dirty desk tops. Some workers in the commercial residential and government cleaning sectors reported that they found the cleaning cloths too small and slow, and substituted them for small hand towels in order to cover a wider area.

4.6.7 Equipment selection, purchase and maintenance

Four of the seven employers responded to the survey regarding their rationale for equipment selection, and regarding the specific equipment they recommended for the common cleaning tasks.

According to the respondents, companies usually relied on the skills and experience of various managers when selecting equipment. With some companies this included a site evaluation and an equipment trial involving the cleaning workers or housekeeping staff. However the responses to the survey indicated that the risk assessment process did not consistently involve the workers who use the equipment and know the tasks, as is required under the OHS Act, and generally relied on a manager’s assessment with no apparent regard for the workers’ opinions or preferences. Assistance and input from OHS and Injury Management personnel could provide value in this assessment as they should be familiar with the current risk assessment tools and be aware of some of the risk factors to be aware of.

According to interviews and information from managers during the site visits and from the completed written surveys, each company had what they believed was a systematic and comprehensive way of ensuring the equipment used by their staff was appropriate, well maintained and replaced as necessary. They also reported that had the necessary systems in place to ensure all staff were properly trained in the use of equipment and in the ability to manage all work tasks safely. They also reported that if problems or queries arose they were quickly and efficiently remedied.

While the companies’ various policies and systems were not reviewed formally, from observations of the equipment and work practices and information provided in the interviews, it would appear that the systems for the selection, use and maintenance of equipment are not implemented or not working in a large number of the worksites visited. This was commonly observed in the government contract sites.

The main problems typically observed and reported by the cleaners at government sites were identified as:
- the age of the equipment;
- the poor state of some equipment; and
- the time delays in repair or replacement of equipment.

This was evident by faulty and damaged equipment such as:
- masking tape used to mend vacuum hoses;
- broken straps on backpack vacuums;
- dust-control mops with damaged splayed mechanisms; and
- sites where workers had placed simple requests (such as for a new mop head) and this had reportedly not been supplied “…for months!!”.

At some sites the cleaning and/or housekeeping staff consistently made the same complaints and reported being dissatisfied with their employer/manager regarding equipment provision and maintenance. The workers also reported being frustrated by this apparent inaction or disinterest.

However, there were also a number of sites where there was consistent satisfaction among staff regarding equipment supply and maintenance. At these sites the equipment was observed to be newer and in better condition. Also while some companies supplied equipment such as long-handled brush and dustpan as a standard piece of equipment, this procedure/practice was not evident in other sites although staff reported they would prefer them to the standard brushes and pans.

The following negative and positive comments by cleaners at the sites highlight some of the findings:

Negative comments:
- “Waste time moving equipment between buildings. Always try to save time!” (Cleaner, Primary School)
- “The backpack doesn’t suit me” (small Cleaner, Primary School)
- “It’s like getting blood out of a stone. You just have to make do” - regarding obtaining repairs or replacement equipment (Cleaner, Primary School)

Positive comments:
- “[Supervisor name] asked us what we wanted and left spares in case one broke down” - regarding vacuum cleaners (Cleaner, High School)
- “We have a vacuum in each separate building and a spare vacuum in each school” (Supervisor)
- “She asked me what was hard, and I said the low desks. So she gave me a short handled mop!”

A work practice observed at a number of the hospitality sites was for workers to be on their hands and knees to clean bathroom floors and walls in hotel rooms despite the availability (in the market place) of alternate and more comfortable and safer methods. When the managers and workers were questioned regarding these large work practices they were considered to be standard and accepted work practices by both parties.

Table 21 – Equipment in use at sites visited

<table>
<thead>
<tr>
<th>Equipment used for common tasks</th>
<th>Government contract - Schools</th>
<th>Commercial office buildings</th>
<th>Commercial recreational and accommodation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Floor washing and wet-mopping</td>
<td>Wet mop and bucket used for all hard surfaces, such as toilet floors, kitchens, halls, large foyer, science rooms etc.</td>
<td>Wet mop and bucket used for hard surfaces, such as toilet floors, foyers, small foyer.</td>
<td>Mechanical equipment for non-carpeted areas – Washington, Domestic offices, site between levels</td>
</tr>
<tr>
<td>Non-carpeted areas – Non-carpeted areas – Washroom, Domestic offices, site between levels</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Cleaners have upright vacuums for the toilet area. The vacuum used was a long handled model, with a flexible hose that can be used for cleaning hard to reach areas. The vacuum head was also adjustable to suit different surfaces.

Vacuuming cleaning materials typically included backpacks with various bins (either plastic or metal) and bags or using a vacuum cleaner. Various types of sponges and cloths were used, depending on the area being cleaned. Some cleaners used cleaning strips, while others used micro-fibre dusters. Some cleaners used their own mixtures of cleaning products, while others used products provided by their employers.

Floor polishing included the use of mops and polishers. Some cleaners used self-service paper-towel mops, while others used manual mops or polishers. The choice of equipment depended on the size and type of the area being cleaned. Some cleaners used their own mops, while others used those provided by their employers.

Cleaning and trash duties included the use of trash bags and bins. Some cleaners used plastic bags, while others used cloth bags. The choice of bag depended on the size and type of the area being cleaned. Some cleaners used their own bins, while others used those provided by their employers.

The report recommended the use of equipment that can be easily lifted and carried, and that can be easily cleaned and disinfected. It also recommended the use of equipment that is ergonomically designed to reduce the risk of injury. The report also recommended that cleaners receive training in the safe use of equipment and safe work practices.
4.7 Work environment

The study highlighted major differences between the work environments of schools, commercial office buildings and the hospitality industry (recreational and accommodation) that affected the range of cleaning tasks, the ease of cleaning and the general physical demands of these tasks.

Comments made by workers at the sites help to illustrate some of the key issues:

- "Young children use lots of dirty stuff" - referring to glue, texts and paint in the room (Cleaner, Primary School)
- "I have as much time... I could do other things" - about having to close many windows (Cleaner, High School)
- "Winter is worse. The mud!" (Cleaner, Primary School)
- "Weather and wind make it worse"
- "Used to have to pull this (floor polisher) up these steps" - referring to steps recently modified to suit a disabled student (Cleaner, High School)

Based on the environmental assessment (listed in Table 22), the least physically demanding work environment appeared to be in the commercial office environments. This was due mainly to:

- the age and design of the buildings;
- the high level of dirt and waste;
- the user groups (i.e. active children).

The key differences are summarised in Table 22.

Table 22 - Comparison of features of different work environments

<table>
<thead>
<tr>
<th>Environmental features</th>
<th>Government contract - Schools</th>
<th>Commercial office buildings</th>
<th>Commercial recreational and accommodation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical flooring</td>
<td>Primary schools - Carpet</td>
<td>Carpet in offices</td>
<td>Wall-to-wall carpet</td>
</tr>
<tr>
<td></td>
<td>throughout most classrooms</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>High schools - Mix of carpet and linoleum in high schools</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Uniforms in hallways, and specific areas (Art, Science, Music rooms)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Typical design of areas cleared, and typical layouts</td>
<td>Generally greasy and soapy, small buildings, separated by courtyards and playgrounds accessed via paths and steps. Includes temporary demountable classrooms and rooms with stored areas</td>
<td>Generally open plan office workstations, with groups of large desks (1.2m x 0.8m deep top and various L-shaped designs)</td>
<td>Desk clusters generally fixed to partitions</td>
</tr>
<tr>
<td></td>
<td>Classrooms with various dust configurations, with about 20 chairs and desks, with minimal space to walk between and around desks. Shelves are low. Around one or two tables of the rooms, often in front of windows (Cleaner, Primary School)</td>
<td>Office blocks - small to medium office blocks. Workplaces grouped in large desks (1.2m x 0.8m deep top and various L-shaped designs).</td>
<td>Desk generally fixed to partitions</td>
</tr>
<tr>
<td></td>
<td>Typical student desks were small (desk tops measuring around 600mm x 400mm); student chairs were sometimes balanced on the desks.</td>
<td>Large and more stable desks or benches were often used in Science and Art rooms.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Larger and more stable desks or benches were also often used in Science and Art rooms.</td>
<td>Other informal areas: staff rooms, specialists rooms (e.g. Art, Science laboratories, Music Rooms, computers etc).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Larger and more stable desks or benches were also often used in Science and Art rooms.</td>
<td>Large toilet blocks (1.2m x 0.8m)</td>
<td></td>
</tr>
<tr>
<td>Main waste collected from internal waste bins</td>
<td>Papers</td>
<td>Food wrapping</td>
<td>Paper waste containers</td>
</tr>
<tr>
<td></td>
<td>Food wrapping</td>
<td>Drink containers</td>
<td>Industrial waste (paper, plastic, etc.)</td>
</tr>
<tr>
<td></td>
<td>Drink containers</td>
<td>Industrial waste (paper, plastic, etc.)</td>
<td>Recycling (plastic, etc.)</td>
</tr>
<tr>
<td>Furniture to be moved</td>
<td>Desk chairs (4 legs)</td>
<td>Staff chairs (4 legs)</td>
<td>Staff chairs with wheels</td>
</tr>
<tr>
<td></td>
<td>Chairs on casters</td>
<td>Chairs on casters</td>
<td>Chairs on casters</td>
</tr>
</tbody>
</table>

For more information, please refer to the full report by Health & Safety Matters Pty Ltd, February 2005.
### Environmental Features

<table>
<thead>
<tr>
<th>Government contract</th>
<th>Schools</th>
<th>Commercial office buildings</th>
<th>Commercial recreational and accommodation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student desks/tables</td>
<td>Some boardrooms or lunchroom chairs with 4 legs</td>
<td>Heavy solid chairs, and 4 legged chairs at cafes and restaurants</td>
<td>Residential areas – Beds on castors</td>
</tr>
<tr>
<td>Furniture to clean under</td>
<td>Primary schools have very low tables and benches and aisles (eg 600mm high) and low tables</td>
<td>Desk tops and tables generally 850 to 920mm high</td>
<td>Recreational areas - large numbers of gaming machines that require cleaning and damp wiping</td>
</tr>
<tr>
<td>High schools have higher desks and larger furniture</td>
<td></td>
<td>Kitchen benches generally 800mm</td>
<td>Residential areas – Feed on occasions only, with occasional cleaning, with small gap underneath</td>
</tr>
</tbody>
</table>

### Amount of dirt visible

| Dirt and mud are typical, with mud a particular problem in wet weather | Minimal dirt | Minimal dirt |
| Leaves and rubbish blow in from playground | May have leaves blowing into the foyer area | May have leaves blowing into the foyer area |
| Children eat and play inside in wet weather |

### Main user population

| Children from age 0 to 18 | Adult office workers | Mainly adults |
| | | Adults may be under the influence of alcohol and other drugs |

### General condition of carpeted flooring pre-cleaning

| High number of waste articles and dirt per square metre (eg small paper scraps, paperweights, foodstuffs, food scraps, pencil sharpenings, chalk dust) | Low number of waste articles and dirt per square metre (eg small paper scraps, paperweights) | Recreational areas - Variable, dependent on number of patrons, day of the year, events, food and drink areas etc. |
| | | Mostly foodstuffs, spill drinks, cigarette butts, small paper scraps, | |
| | | Peak times eg Friday and Saturday |
| | | Residential areas – Variable, but generally low |

### Dust condition of hard flooring pre-cleaning (toilets and bathrooms excluded)

| High number of waste articles and dirt per square metre (eg small paper scraps, foodstuffs, small paper scraps, paperweights) | Low number of waste articles and dirt per square metre (eg small paper scraps, foodstuffs, small paper scraps, paperweights) | Recreational areas - Variable, dependent on number of patrons, day of the week, events, food and drink areas etc. |
| | | Mostly foodstuffs, spill drinks, cigarette butts, small paper scraps, | |
| | | Peak times eg Friday and Saturday |
| | | Residential areas – Variable, but generally low |

### General condition of toilets

| Often marked with graffiti, paint, food marks, sticky foodstuffs | Generally just dirt and occasional coffee stain | Can be very sticky with spill drinks and foodstuffs |

### Equipment and paperwork etc on bald heads

| Variable | Cleaners had computers on each desk with varying amount of paperwork on other side | Recreational areas - Variable |
| | | Residential areas – Variable |

---

### Condition of toilets

| Can be very poor in toilet blocks with human excrement on the floor and walls, toilet paper pulled out and on floor, and female sanitary products | Generally in reasonable condition, with occasional dirty areas/inserts | Toilets in public areas (eg Food courts) are generally in much worse state than the office areas |

### Access between floors

| Stairs are used as common areas via lifts for disabled access | All premises had lifts | All premises had lifts |

### Cleaners room - design, number and location

| Schools had a cupboards/pockets in each building | Typically a large cleaners room was located in the basement, with a large room for hanging and folding drying, another room for supplies and for chemical storage and dispensing. Some self-contained chemical dispensers were seen | Recreational - variable |

### Access to hot water

| Limited use of hot water | Hot water usually taken from warm tap, transported via the lift (though cold water from sink is available most floors) | Residential areas - hot water available from handbasins |

### Ventilation during cleaning

| Windows mainly closed, so draughty conditions and hot in warm weather | In most cases, streching was turned off or very low resulting in heat and stuffiness in buildings | Recreational areas - Airconditioned buildings but aircon not always on when building is cleaned |

### Concentration of people per area of flooring

| High concentration of people in classrooms (20) | Low concentration of people | Recreational areas - Can be very high concentration of people, with standing room only at peak periods |

### Food/drink areas

| Food and drink commonly eaten in classrooms, canteens and on corridors | Food often eaten at desks, and prepared in small kitchens. | Restaurants, cafes and bars |

### Time building is used

| Monday to Friday approximately 8am to 4pm | Monday to Friday approximately 7.30 to 9pm | Generally 7 days a week |
4.8 Weights and forces

A range of commonly used equipment was reviewed. Typical loads lifted and carried by workers were between 5 - 8kg, and this lifting was in a range of postures, often in twisted, bent and other poor postures, so placing workers at risk of MSDs. The heaviest lifting and handling identified was to move furniture and floor polishers.

Forces required also varied, with some equipment requiring minimal force to move over the floor surface (eg dust control mop) and other requiring greater force (eg wet mop on a very dirty surface). The largest forces measured were to push and pull trolleys used in the commercial residential sector to carry cleaning equipment, bed linen and towels etc, and also the forces to open and close roller doors. Some windows in the schools also required high forces to open and close, but this force could not be measured. Table 23 provides a summary of typical weights and forces.

While the most common weights are less than 10kg, the degree of risk is affected by the posture, duration, repetition etc required in the task, and individual characteristics of the worker. Similarly, some of the forces required maximum effort by some workers, such as pulling and pushing jammed windows, the linen trolleys and opening roller doors.

Table 23 – Summary of typical weights and forces

<table>
<thead>
<tr>
<th>Range of weights and forces</th>
<th>Load lifted or handled</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical items lifted or carried</td>
<td>Backpack vacuum</td>
<td>5-6kg</td>
</tr>
<tr>
<td></td>
<td>Bags of waste paper</td>
<td>3-7kg</td>
</tr>
<tr>
<td></td>
<td>Canister vacuums - eg out of cleaners room or up &amp; down</td>
<td>5-9kg</td>
</tr>
<tr>
<td></td>
<td>Bucket of water from sink</td>
<td>5kg</td>
</tr>
<tr>
<td></td>
<td>Chemical containers</td>
<td>5kg</td>
</tr>
<tr>
<td></td>
<td>Steel waste paper bins - small</td>
<td>&lt;1kg</td>
</tr>
<tr>
<td></td>
<td>Steel waste paper bins - 45 to 55 litre capacity</td>
<td>2.5 – 3.5kg, of empty bin</td>
</tr>
<tr>
<td>Heaviest items lifted or carried</td>
<td>Floor polishers, up steps</td>
<td>42kg</td>
</tr>
<tr>
<td></td>
<td>Ad room waste (eg silt, wood, clay)</td>
<td>Estimated as up to 40kg with full bins</td>
</tr>
<tr>
<td></td>
<td>25 litre containers of chemicals (generally lifted onto a shelf then a tap is inserted for dispensing)</td>
<td>20kg</td>
</tr>
<tr>
<td></td>
<td>Chairs, tables and other furniture – moved for end of term clean up in schools. Includes moving counters and book cases etc.</td>
<td>Wide range</td>
</tr>
<tr>
<td></td>
<td>Tasks requiring pulling or pushing forces:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pulling various canister vacuums over various low pile carpets</td>
<td>1kg – 5kg (varied with wheel orientation, carpet, load etc)</td>
</tr>
<tr>
<td></td>
<td>Pushing heavily laden trolleys (eg in hospitality)</td>
<td>10-12kg (carried with</td>
</tr>
</tbody>
</table>
4.9 Employer survey

It is postulated that training has a potential impact on MSDs. As such, in addition to questions regarding equipment, employers were asked about training. "Three of the seven employers completed and returned the surveys, and these represented a large number of cleaning workers. No further details on businesses can be provided due to confidentiality agreements.

The type and duration of training reportedly varied between companies and sectors, from very fundamental (on the job) direction by another worker, to workers' attendance at more formal courses. According to the survey, some cleaning workers had commenced or completed studies towards a qualification in Asset Management. These courses range from the 6 month, Certificate II in Cleaning Operations, to the 2 year Certificate IV in Cleaning Operations Management.

However, the number of staff who had yet to undergo any induction training, risk management training and manual handling training was a concern. While some companies only employed people with good conversational English, others employed people with very limited English. Given the high number of workers from non-English speaking backgrounds, it was interesting to see how this was managed in the context of training. In the survey, employers reported using strategies including: demonstration; use of interpreters, and ongoing practical instruction. One company reported also using the worker's family members (such as high school age children) to assist in reading and understanding any written information that was taken home by the worker. Only one company reported using pictorials; and ongoing practical instruction. One company reported also using the worker's family members (such as high school age children) to assist in reading and understanding any written information that was taken home by the worker. Only one company reported using interpreters, and no workplaces reported using multilingual material.

From talking to the workers, it was apparent that there were areas where instruction and training was still indicated, and in a language other than English. For example, in the cleaners' rooms there was often written information (eg Material Safety Data sheets and Injury and Hazard Report Forms etc) however this information was in English, and was generally difficult to read due to the small font and the poor lighting in the cleaners' rooms.

<table>
<thead>
<tr>
<th>Task</th>
<th>Type of Training</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulling chain to open roller doors (eg in playgrounds and to close off canteen/delivery areas)</td>
<td>Wheel orientation, carpet, load etc</td>
</tr>
<tr>
<td>Pulling and pushing sash windows (in open or close them)</td>
<td>Unable to measure. In some cases, maximum force applied by workers and researchers could not be measured.</td>
</tr>
<tr>
<td>Pulling mop through wringer</td>
<td>14-15kg (as measured in Fowler et al. 1997)</td>
</tr>
</tbody>
</table>

5. Summary & Conclusions

5.1 Overview

The job of cleaning at government sites (eg schools) and at commercial sites (office, recreational and residential) exposes these workers to high risk of developing work-related upper limb MSDs. The literature shows there is strong evidence to support the link between MSDs and:

- physical risk factors - such as force, posture, repetition and a combination of these factors; equipment; environment; and
- work organisation factors, and
- individual factors.

The focus of the study was therefore not restricted to physical risk factors, but investigated each of the above areas. This approach is consistent with the most up to date, evidence based literature on MSDs, their risk factors and prevention.

5.2 Physical risk factors

5.2.1 Task demands

The semi-quantitative assessment tools that were selected for use (ManTRA and RULA) highlighted the problems associated with the simultaneous exposure to multiple risk factors. Repetition, force, speed, static loading, awkward postures and other factors combined to make all of the assessed tasks high risk for the development of MSDs. The physical risk analysis identified that each of the common cleaning tasks was classified as "requiring change" due to the high levels of risk, especially for the upper limb. Wet-mopping was identified as requiring the most immediate action.

The repetitive nature of these cleaning tasks was also a concern, and when the specific repetitions were compared against risk criteria (Kilborn 1994) the tasks were all rated as being high risk for the upper limb, particularly when combined with the other physical risk factors. Another factor increasing risk was that some tasks required similar postures and movements - eg wet mopping and static mopping – which resulted in limited opportunity to use different muscle groups.

The overall exposure time and the impact of other jobs was likely to further increase risk of MSDs due to their cumulative effect, and the exposure to multiple risk factors. In the commercial residential and recreational sectors the tasks assessed using ManTRA generally had higher cumulative risk scores, and this was mainly due to the longer exposure time of workers due to their longer shifts.

One reason that the overall ManTRA cumulative risk scores were just below 15 (where action needs to be taken) is that the common work arrangements are for government and commercial office cleaners to work short shifts (3 to 4 hours) and split shifts. The current split shift arrangement for government cleaners may have some protective effect in allowing
5.2.2 Equipment

A major factor contributing to the risk of MSDs was the lack of suitable equipment at many of the sites visited. Workers were often using equipment that was not well suited to the task, the user or the environment or equipment that was not properly maintained. Our findings were consistent with an earlier study of school cleaners in NSW schools and technical colleges (Gaudry 1998).

Despite the legislation regarding consultation, workers generally reported not being involved with equipment selection. It is postulated that this may have contributed to some unsuitable equipment being chosen for use. For example, the method of cleaning the flooring in public toilets and hotel bathrooms on the hands and knees placed workers at unnecessary and unacceptable injury and disease risk.

The workers interviewed also reported feeling frustrated that they had not been consulted regarding equipment selection, adding to their feelings of lack of control and lack of support which are themselves risk factors for upper limb MSDs according to the literature (Macdonald et al. 2000). Our findings are consistent with findings from other cleaning studies that concluded that there appears to be a lack of assessment and trial of equipment prior to purchase; a lack of consultation with the users; unsuitable or non-existent maintenance and replacement schedules; and some confusion over roles and responsibilities of the parties regarding equipment purchase, maintenance, and storage (Woods et al. 1999; Woods & Ilkics in press 2004; Gaudry 1998; Aickin & Carasco 1998; Paver et al. 1997).

The selection, supply and maintenance of equipment are areas within the cleaning industry where improvements can most easily be made. Having the right equipment could help to achieve better cleaning standards, improved productivity, increased worker morale and would reduce the risk of workers sustaining a MSD or other injury.

5.2.3 Work environment

The work environments in this study also had significant impacts on the physical demands of cleaning work, and this is consistent with findings from other studies (Paver et al. 1997; Woods et al. 1999; Messing et al. 1998; Johansson & Ljunggren 1989, Smedje & Norback 2003). Of the 3 sectors, the government schools appeared to pose the greatest risk to workers due to factors such as:

- difficult access (stairs and steps)
- degree of dirt tracked inside
- heights of furniture and fixtures (eg in primary schools)
- user population
- the age and design of the buildings

recovery/hyster between shifts, and therefore reducing risk of developing a MSD. Any increase in shift length or removal of split shifts should be considered with caution as increasing hours per shift (eg to 6 – 8 hours) is likely to increase the risk of MSDs. Consideration would need to be given to adequate rest breaks, proper equipment selection, and work organisation factors such as control over work, task variety etc to successfully manage any change. Having a second job that is also physically demanding would further increase the risk of developing a MSD due to the cumulative effect.

While the design of existing buildings, furniture and fittings can be hard to remedy immediately, any refurbishments or changes should be designed with consideration of the cleaning requirements and the workers, aiming to reduce the risk of injury associated with this work.

Furthermore, the owners/controllers of worksites need to be cognisant of the fact that they also have responsibilities for health and safety, including providing and maintaining safe access/egress and ensuring that contractors are not exposed to risks to their health and safety.

5.3 Work organisation factors

The organisation and management of work is a recognised risk factor for MSDs. Workers interviewed as part of this study identified the following issues in relation to work organisation factors:

- work rates;
- lack of control over the amount of work;
- lack of ability to get help (if required) and
- lack of support from supervisors.

Job demands, job stress and job support are all predictors of increased risk of MSDs (Bongers et al. 1993), and are independent of the physical risk factors that workers are exposed to (Bernard 1997).

The findings from this study suggest that many workers are having difficulty with the current work rates, with 53% of workers reporting often working very fast, 20% reporting never having enough time to complete their work, and 53% only sometimes having enough time to complete their work. According to Macdonald (2000) each of these factors is an indication that work rates need to be reviewed and adjusted. Together with the physical risk factors discussed above, there would appear to be an increased risk of these workers sustaining MSDs.

It was also evident that most workers had not been sufficiently involved in the process of determining work rates, or more commonly, had no say in their work rates. This lack of consultation and involvement is in itself a predictor of low acceptance of a work rate (Macdonald et al. 2000). Other factors that are reported to reduce the acceptance of work rates are:

- high ratings of fatigue, high task difficulty, and work rate considered to be more important than quality.

The conflict between work quality versus work rate was a particular issue with government sector workers as they often commented that they felt forced to compromise too much and could not achieve a good job. Unfortunately highly motivated workers are believed to place themselves at greater injury risk than less motivated workers as they are most likely to perform close to their maximum capacity (Macdonald 2003). This is also expected to be the case where workers wish to achieve a high quality job to aid in their work satisfaction and personal esteem. It is argued that permitting or encouraging workers to operate at "chronically excessive workloads" should be prohibited due to the well known hazards and high injury and disease risk, not just for work-related MSDs (Macdonald 2003).

The common trend reported by workers in each sector was for management to increase work rates, and to set these rates with no or minimal consultation with the workers.
As Macdonald explains (2003), workers are very adaptable to work overload, but work performance degrades with overload. Although there is no clearly delineated point at which overload occurs, workers are usually aware when overload is being experienced and where possible, may take a break or change tasks. However, the lack of control experienced by the workers in this study may mean that this coping method cannot be used, placing them at increased risk of injury. Job demands and job control are closely linked, and Macdonald (2003) outlines how stress, and consequently the risk of a MSD, is more likely to occur when people are constrained in the way they carry out their work and cope with the demands of the task. Having a higher level of control enables people to take action to reduce the actual or potential stressors.

The lack of support at work is another factor contributing to MSDs, and good support has the reverse affect. A study of cleaners and their support at work showed the significant and positive impact that personnel support has on preventing or reducing absenteeism from MSDs (Landstad et al 2001). However, our study found that 36% of workers indicated that they were not happy with the support and feedback they received from their supervisors.

Discussions with workers revealed that there were two different types of support that appeared to be lacking. One type of support was related to the availability or quality of equipment and staffing levels, and the other was related to positive feedback and other factors that impacted on workers' morale. The provision of good support has been identified as improving a worker's coping capacity and making the work more energy efficient, both contributing to an overall increase in productivity and potentially a reduction in injury risk (Macdonald 2003).

5.4 Individual factors

According to the literature, the individual characteristics of workers may also affect their injury risk, with increasing age, being female, and working with a pre-existing injury placing workers at increased risk. These characteristics were typical in the workers surveyed. The average age of the workers in this study was 46.7 years, with government contract cleaners significantly older (aged 53.5 years) than workers in the other sectors, and females made up 70% of the sample. The author of a study regarding similarly aged cleaners in Denmark (Nielsen 1992) warned that there would be problems for this ageing workforce if the work environment and workload was "not made to fit the elderly employed". The Danish study also noted that both the 'young' and 'elderly' cleaners complained of the physical demands of their work, including the work postures, heavy lifting, repetitive work, and high work pace in their jobs.

Another concern in this study was that a large proportion of workers were working with reported pain and discomfort. Eighty-three percent of workers reported pain or discomfort in the last 12 months, and 69% of workers reported pain or bodily discomfort in the last 7 days. Those individual risk factors, combined with those relating to physical and work organisation risk factors, are placing this population at increased risk of injury. In conducting risk assessments in the cleaning industry it is clear that the workers' individual characteristics require careful consideration and recognition.

6. Conclusion

When assessing the risk of MSDs in any industry consideration needs to be given to all the factors that have been identified as contributing to MSDs. Physical risk factors - such as working in awkward postures, working under high static load, repetitive work, high forces, working with vibration, and combinations of these factors - are all strongly associated with the development of MSDs (OSHA 1999). As well as identifying physical, equipment and work environment factors, the importance of work organisation factors in the development of MSDs cannot be overlooked (Borg at al 1994; Larssen & Devereux 2002).

The findings from this study are consistent with other research into cleaning work overseas and in Australia that has confirmed that the physical demands, work organisation factors and individual characteristics of workers present a number of risk factors known to contribute to injury and disease, including specific risks for the development of upper limb MSDs.

The prevention and management of MSDs appeared to be poorly understood across the cleaning industry in general, and at the sites visited. This was evidenced by survey results, site observation, and discussions with a wide range of people involved with cleaning in each of the sectors. Other parties involved with contractors or the cleaning industry also appeared unaware of their OHS responsibilities. This included site owner controllers, equipment designers and manufacturers, and equipment purchasers. Knowledge of OHS requirements is a fundamental requirement at all levels, with management, supervisors, purchasers and designers all having responsibilities.

With the current conditions in the cleaning industry, any expectation of improvements in productivity without significant changes in work organisation, the work environment or equipment would be unrealistic, and would be placing workers at further and unnecessary risk of sustaining a MSD.

Considering the overall situation in the cleaning industry, the areas where the most significant improvements could be made in reducing the risk of MSD are with work organisation and equipment. For example, the provision of better personnel management and support and improved equipment design, provision and storage would have a major impact.

While one of the original aims of the study was to develop guidance for workers about common cleaning tasks, the results of this study show that this group has minimal if any influence on their work. They are not generally involved in selecting the equipment for their tasks, and are not involved in establishing work rates and influencing other work organisation factors. This study and the reviewed literature show that to have the most impact, change is required at the level of management and senior supervisors. The evidence based guide is therefore targeted at this group rather than cleaning workers.
7. Recommendations

7.1 Introduction

The results of this study and findings from recent systematic reviews and other studies show that upper limb MSDs in cleaning work develop from the complex interaction of many risk factors. This evidence clearly shows that considering only one or a few risk factors (such as repetition, duration or force etc) is an inappropriate and ineffective approach to managing and preventing risk of workers developing MSDs. This project has highlighted that doing cleaning work is 'high risk' due to a combination of the physical risk factors, work organisation risk factors and individual risk factors.

There is however good evidence of very specific factors that can increase or reduce risk of workers developing upper limb MSDs.

The first step to managing the problems associated with the repetitive manual tasks of cleaners is for organisations engaging these workers to use a much more systematic approach to OHS management. Although the focus of this project was on selected cleaning tasks, before risks associated with these tasks can be controlled, improved OHS systems need to be implemented. All organisations involved in the employment and contracting of these workers need to be more cognisant of OHS philosophy, OHS management systems and the process of risk management. Until these organisations implement the fundamental principles of OHS management, controlling the risks associated with these manual handling tasks will not be sustainable.

Australia's National Occupational Health and Safety Commission has listed the priority 'areas for action' to achieve improvements in workplace health and safety (NOHSC 2002b):

- Strengthen the capacity of government to influence OHS outcomes
- Eliminate hazards at the design stage
- Improve the capacity of business operators and workers to manage OHS effectively
- Prevent occupational disease more effectively
- Reduce high incidence/severity risks.

Each of these areas needs to be considered to achieve a reduction in the upper limb MSD problems experienced by workers performing repetitive cleaning tasks.

These areas of action are consistent with the international models of injury prevention and health promotion which are based on the premise that government policies and actions can either facilitate or discourage actions resulting in good health or safe behaviours. These approaches also place responsibility on all stakeholders, but particularly those who have the power and influence to achieve change and 'create supportive environments'. The cornerstone to this philosophy is that policies, systems and the individual's environment have a greater impact on health than an individual's personal skills, knowledge or behaviour (Ottawa Charter 1986).

Also, the focus is proactive and aimed at the prevention of injury and disease rather than being reactive to injuries and focusing on a treatment or an injury management model.

The preventative approach for MSDs must be comprehensive and include the assessment and management of the identified work organisation and psychosocial factors, which are currently often neglected in MSD prevention. Historically the emphasis in Australia has been on the more concrete and visible issues of equipment and physical workplace design. In the Dutch legislation, psychosocial factors are reportedly now recognized as comparable in importance to the other workplace hazards such as physical, biological or chemical hazards. The cumulative impact of the risk factors also needs further research and recognition for MSDs.

7.2 Recommendations to WorkCover NSW

7.2.1 Legislation and guidance

- Review the newly introduced 'Code of Best Employment Practice for the Cleaning Industry' from the ACT, and consider its application in NSW and other states. This Code aims to provide a form of self-regulation for the Cleaning Industry where signatories to the Code are audited and monitored to ensure compliance with current OHS requirements in addition to other legal duties (Ryan 2004). Cleaning companies are encouraged to participate and become signatories to the Code by demonstrating that they are meeting their obligations and are suitable candidates to gain cleaning contracts without placing employees at undue risk of injury.

- Assist in educating and guiding industry in their responsibilities to workers and contractors through the provision of tailored and targeted resources such as the newly developed Evidence Based Guide to Safer Cleaning work. Also further promote the Guide to Property Owners and Managers – Guide 1 (WorkCover 2003a), Guards for Cleaning Employers and Contractors – Guide 2 (WorkCover 2003b) and other relevant and existing resources for this industry as these are not currently well promoted within the Industry.

- Provide tailored resources to the Inspectorate and those employing workers to perform cleaning tasks, such as those developed as part of this project (The Evidence Based Guide to Safer Cleaning Work and Risk Assessment Guide). Tools such as these assist in determining cleaning companies' compliance with managing MSDs and clearly illustrate the high risk and low risk approaches to cleaning work in general, advice on specific cleaning tasks, and also facilitate a risk management approach.

- Continue to emphasise the need for good design in all plant (equipment) and workplace layout, through ensuring that the requirements of designers, manufacturers, suppliers and employers are included in relevant legislation and guidance material, including the new Standard and Code of Practice for Manual Handling.

- Assist with the NOHSC Safe Design Action Plan (NOHSC 2004) to ensure that the designs of buildings facilitate and allow safe work for all people in the building including cleaners and room attendants, with the workers' needs incorporated at the design stage.

- Continue to work towards incorporating work organisation and psychosocial risk factors into Standards, Code of Practice and Guidance Material for industry to encourage its recognition (WERC 2003b). A greater recognition of the cumulative effects of exposure to MSD risk factors is also important, and is of particular concern for cleaning workers.

- Review methods of assessing work organisation and psychosocial issues in Australian workplaces and specifically with cleaners, and promote and encourage ongoing research in this area (eg as is underway at the Work Environment Research Centre in Victoria – WERC 2003b, and at the University of South Australia – Dollard 2004). Assessment tools should be suited to the different occupational groups and to different languages to facilitate this process.
7.2.2 Resources for the cleaning industry and rehabilitation providers

- Promote OHS and MSD issues to small and medium-sized enterprises. Short seminars and the use of industry peers have been identified as an effective way to reach small and medium-sized enterprises (Mayhew 1997).

8. References


Final Report - Assessment of the Repetitive Manual Tasks of Cleaners


Building Services Association, 2004, personal communications and website: www.bsca.asn.au


Caple D & Associates, 2003, Physical safety in small and medium-sized enterprises (SME’s): strategies for addressing the special needs of these organisations and their employees, Issues Paper 3- report to NOHSC, Canberra


Commonwealth Department of Human Services and Health, 1994, Better health Outcomes for Australians, AGPS, Canberra

Cook, C 2004, personal communication


Grandjean E, 1989, Fitting the task to the man – A textbook of occupational ergonomics, Taylor & Francis


Hagner I, & Hagberg, M 1989, Evaluation of two floor mopping work methods by measurement of load, Ergonomics, 32, 401-408


Hurrell JJ, Nelson DL & Simmons BL 1998, Measuring job stressors and strains: where we have been, where we are, and where we need to go, Journal of Occupational Health Psychology 3(4):368-389


Ketula R, Tolvanen R & Vilkari-Juntura E, 2001, Inter-observer repeatability and validity of an observation method to assess physical loads imposed on the upper extremities, Ergonomics, 44(2), 119 – 133


Larsson B, Bjork J, Henriksson KG, Gerde B & Lindman R, 2000, The prevalences of cytochrome c oxidase negative and superoxide fibres and ragged red fibres in the trapezius muscle of female cleaners with and without myalgia and of female healthy controls, Pain. 84(2-3):379-87

Laurensen, B., Søgaard K & Søgaard G, 2003, Biomechanical model predicting electromyographic activity in three shoulder muscles from 3D kinematics and external forces during cleaning work, Clinical Biomechanics. 18(4):287-95


Marmot MG, 1994, Social differentials in health within and between populations, Journal of American Academy of Arts and Sciences, 123, 187-216


Microfibre Cleaning Technology, 2004, Product material and personal communications


Schaftel W & Kompier M, 2002, Managing job stress in the Netherlands, TUTB Newsletter No 31


Standards Australia (1994) SAA HB59 Ergonomics – The human factor. A practical approach to work systems design

Stevenson MG, 1999, *Notes on the Principles of Ergonomics*, University of Sydney


Vaas, D, Dhondt, Peeters & Middendorp, 1995 *WEBA*

Van Veldhoven M, Meijman T, Broersen JPJ & Fortuin RJ, 1997, Handling VRBA [VRBA Text Manual], Amsterdam, Stichting Kwaliteitsbeoordering Bedrijfsgesondheidszorg


Weigall, F, Simpson, K, & Bell, A 2004a, Report 1 - Analysis of claims data for the WorkCover Cleaning Industry Steering Committee, unpublished


Work Environment Research Centre 2003a, Summary of current and emerging issues (other than psychosocial) in the physical handling work environment, Issues Paper 1, report to NOHSC, Canberra

Work Environment Research Centre 2003b, How to identify and assess the determinants of work-related stress in physical handling work environments and, based on this, how to reduce workplace stress levels in such environments, Issues Paper 6, report to NOHSC, Canberra


Schaufeli W & Komplior M, 2002, Managing job stress in the Netherlands, TUTB Newsletter No 31


Standards Australia (1994) SAA H859 Ergonomics – The human factor. A practical approach to work systems design

Stevenson MG, 1989, Notes on the Principles of Ergonomics, University of Sydney


Vaas, D, 1995, WEBA

Van Veldhoven M, Melijn TF, Broersen JPJ & Fortuin RJ, 1987, Handlaagend VIBA [VIBA Test Manual], Amsterdam, Stichting Kwalaaltesbevordering Bedrijfsgz@heidin@org


Ware JE & CD Sherbourne, 1992, The MOS 36-item Short Form Health Survey (SF-36): I. Conceptual Framework and Item Selection. Medical Care 33, no. 6: 473-83

Weigall, F, Simpson, K & Bell, A 2004a, Report 1 - Analysis of claims data for the WorkCover Cleaning Industry Steering Committee, unpublished


Work Environment Research Centre 2003a, Summary of current and emerging issues (other than psychosocial) in the physical handling work environment, Issues Paper 1, report to NOHSC, Canberra

Work Environment Research Centre 2003b, How to identify and assess the determinants of work-related stress in physical handling work environments and, based on this, how to redesign workplace stress levels in such environments, Issues Paper 6, report to NOHSC, Canberra

WorkCover NSW, 2002a, NSW Workplace Safety Summit: Government Response
WorkCover NSW, 2001a, Workers Compensation Statistics NSW 2000/01
WorkCover NSW, 1998 Health and Safety for Cleaners: Selecting the Right Mopping Equipment
WorkCover NSW, 1995, BackWatch Industry Profile: Health, WorkCover NSW